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CONTENTS

ELECTRIC RAILWAY TRACTION

A Supplement illustrating and describing developments in Electric Railway Traction is presented with each copy of this week's issue.

Compliments of the Season

THE character in the Æneid who remarked that he always feared the Greeks, but did so especially when they brought him gifts, would have lived in a state of constant trepidation from Christmas to the New Year. That is a period at which tokens of remembrance fall like autumn leaves both upon the meritorious and the undeserving, and without disclosing in which category we mentally place ourselves, we draw the attention of our readers to the list on page 77 of the Christmas cards, calendars, and diaries of which we have been the grateful recipients. It is now our pleasure to reciprocate the good wishes of the donors, a task we have to undertake without the assistance of the many artistic devices pressed into service by our well-wishers. We hope that the absence thereof will not disguise the warmth of our feelings in wishing them success in every enterprise of the New Year, or, lest that should be trespassing too far upon the kindness of fate, a fund of inspiration in tackling their individual problems. We shall not dwell upon the latter; at present we are still too close to that season which had, we suspect, infected the countryman who complained to his doctor in the following terms: "I don't know how it be, Sir, for I eats well and I sleeps well, but when it comes to work I goes all of a tremble."

Nine Months' Passenger Train Traffics

From the analysis published with the Ministry of Transport statistics for September, 1935, it appears that passenger train receipts for the first nine months of last year for all standard gauge railways in Great Britain, except London Transport railways and the Whitechapel & Bow, amounted to £53,630,051, an increase of £1,304,314, or 2·49 per cent. Passenger receipts, excluding season tickets, were £37,713,931, an increase of £1,197,698, or 3·28 per cent., and every class of ticket contributed to this improvement except standard fares, which were down £217,680, or 3·95 per cent., and represented little more than 14 per cent. of the total. Season tickets, at £6,385,686, brought in £108,179, or 1·72 per cent., more, but in parcels and miscellaneous traffic the receipts of £9,530,434 showed an improvement of only £1,563, or 0·02 per cent. At the end of July this class of traffic showed an improvement of £31,457, but by the end of August it had been reduced to £3,107, caused mainly by a fall in receipts from parcels under 2 cwt. First class receipts, apart from seasons, have continued to improve, and for the four group companies together brought in £2,563,640 for the nine months, an increase of £133,314, or 5·48 per cent. For individual companies the respective figures were:—

	£		£
L.M.S.R. ..	848,902	+	31,653
L.N.E.R. ..	621,804	+	38,823
G.W.R.	350,870	+	27,121
S.R.	742,064	+	35,717

First class season tickets were generally down, except that the Southern figure of £418,901 is a gain of £18,509.

* * * *

The Week's Traffics

The latest traffic returns of the group companies cover the week ended January 5 in the case of the L.M.S., Great Western, and Southern Railways and therefore include two days of the old year. The L.N.E.R. return for the week ended January 4 includes three days of 1935. As shown by the accompanying table, increases are shown by each of the four companies in passenger train traffics and these increases together total £31,000, and in coal class receipts the aggregate gain of the four companies is £72,000, but in the case of goods receipts there is a net increase of only £9,000. For the four companies the total receipts for the week amount to £2,554,000, an increase of £112,000, or 4·59 per cent.

	1st Week					
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or dec.	
	£	£	£	£	%	
L.M.S.R.	+ 10,000	+ 7,000	+ 38,000	+ 55,000	+ 5·74	
L.N.E.R	+ 7,000	+ 7,000	+ 16,000	+ 30,000	+ 4·05	
G.W.R...	+ 7,000	− 4,000	+ 14,000	+ 17,000	+ 4·00	
S.R.	+ 7,000	− 1,000	+ 4,000	+ 10,000	+ 3·13	

The latest returns of the Irish railways are for the week ended January 3 and therefore include four days of the old year. On the Great Northern the increase for the week is £347, and on the Great Southern £800.

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The Two-Edged Sword

The January issue of *On Time*, the journal of the L.M.S.R. Operating Department, is made the occasion for a New Year message from Mr. C. R. Byrom which is as generous in its appraisement of punctuality progress in 1935 as it is inspiring in its exhortations for 1936. Mr. Byrom shows how widespread is the responsibility for maintaining the "On Time" ideal, and we would add that as the standard is raised, so do the penalties of default and the quarters from which they proceed increase in number. The more fast running is publicised, the greater is the disappointment of travellers at late arrivals. Nor are travellers the only critics. Some accelerated

point-to-point runs involve calls at towns where the express service is scanty, and the improvement of facilities has earned initially favourable comment in the local press. The first failure to maintain a record probably hailed as "epoch-making," is eagerly seized upon by inveterate grumblers to write letters claiming that not only has the railway failed to keep its word regarding its premier trains, but is notoriously blind to local requirements in its less spectacular activities. However unjustified, such attacks have a disastrous effect upon railway relationship with the public. Not only is speed a two-edged sword, but the path of acceleration leads to ever widening responsibilities.

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A Link Between Post Office and Railway

We have frequently called attention to the close association between the Post Office and the railway, and the existence of the Post Office tube railway in London (described in our issue of February 10, 1928) is a tribute to the necessity of providing rapid communication between sorting offices and main-line railway stations. Similar facilities, but on a smaller scale, have recently been provided at Newcastle-on-Tyne where one of the finest new sorting offices has been constructed. The building, which was begun on March 30, 1933, and was formally opened on October 31 last, contains over 100,000 sq. ft. of floor space, and possesses every mechanical labour-saving device known to the Post Office engineers and the Office of Works. Its outstanding feature is a cream-coloured tunnel, 400 ft. in length, running from the basement, under the Post Office garage and Forth Street, and into the Central railway station of the L.N.E.R., connecting with the main platforms by three lifts. It is 28 ft. below street level, cost £40,000 to build, and is lined with 600 tons of iron segments which were cast by a local firm. The construction of the subway was a notable engineering feat, for exceptional difficulties were encountered during its boring. Electric trucks are used to carry the mails from the station, down the lifts, and along the subway to the loading platforms in the basement of the sorting office. Over 4½ million parcels and 200 million letters are dealt with here annually. The new building has its own electric charging plant for these trucks.

* * * *

"It Costs Less to Eat"

Under this heading a writer in the *Railway Age* summarises the striking efforts which are being made by American railways to popularise their dining car service. The Pennsylvania, for example, has established "off hour" dining car service on all its trains carrying "coach," or third class passengers, whereby the car stewards, having ascertained what will be the demand for meals by Pullman passengers, and when it will occur, canvass the coach passengers with special reduced-rate menus to be obtained in the cars before and after the rush period. The Chicago, Milwaukee, St. Paul & Pacific features low cost meals called "Chef's Selections" on various trains, consisting of a single meat or fish course with vegetables and a beverage, at 25 cents, or 1s. Economy meals are served by the Chicago, Burlington & Quincy on trays to passengers in coaches, chair cars, and tourist cars, scrambled eggs and bacon with rolls and tea or coffee, for example, being served at 25 cents or 1s. a head. There can be little doubt that considerably more could be done in this direction in Great Britain than has yet been attempted. The service of "short" meals for the benefit of those who for reasons of appetite or pocket do not desire the whole menu was inaugurated in this country by the G.W.R., but is not yet universal except on the L.N.E.R. Many potential diners may thus be kept out of restaurant cars by uncertainty as to whether or not this facility will be available.

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Restaurant Car Heraldry

We already have in this country certain L.N.E.R. restaurant cars specially decorated to impress passengers with their spaciousness, but in the design of a car to remind beholders of the extent of the system upon which they are travelling we must give the lead to America. The Pennsylvania Railroad has now placed in service a restaurant car decorated with hand-painted coats-of-arms or emblems of the thirteen States, and the District of Columbia, which are served by the company. The emblems are displayed on the interior panels, both between the windows and at the two ends of the car, and the States represented are New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, West Virginia, Kentucky, Ohio. Indiana, Michigan, Illinois, and Missouri. Great care has been taken to secure correct reproduction of heraldic details and colouring, and the official designs of the States and District concerned were placed at the disposal of the railway by the authorities. The car went into service on December 23. It is intended to allot it to different trains for short periods, so that passengers by all the principal Pennsylvania services may have an opportunity of seeing the novel and decorative scheme adopted by the company for drawing attention to its ramifications.

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Argentine Railways and Exchange

Exchange is still the most pressing problem for shareholders in British-owned Argentine railways, and there is no sign at present of a satisfactory solution. The Argentine Government has, admittedly, been for some time making a handsome profit by buying exchange at 15 pesos to the pound and selling it at the officially maintained rate of 17 to the railways, which claim a preferential relief because of the national concessions and the strict Government control under which they work, and of the intense competition to which they are subjected. But this opinion is not shared by other entities, particularly other public utility undertakings. It is also being said in Argentina that whilst the railways have been obtaining exchange at 17 pesos, the public has been paying anything from 18 to 21 on the "free market." Another argument extensively quoted is that had the pound for importers and railways not been "pegged" at 17 pesos, it might have risen considerably higher. Although firmly maintaining the view that the case for the railways is entirely different from that of other public undertakings which can increase their charges to the consumer, while the railways, in view of competition cannot, we have thought it well to give some indication of the opposing views to show the difficulties ahead.

* * * *

Fatal Accidents in 1935

We have often maintained, when discussing the safety of British railways, that it is a more equitable test to take the number of accidents than the number of the resultant casualties; an accident, whether the results be serious or minor, is an event to be avoided. If that argument be accepted the year 1935 may be regarded as a good year in the matter of accidents to passenger trains in which there were fatalities to the passengers. There was only one such accident last year, which, moreover, was the case in four other of the previous ten years—

1932, 1930, 1929, and 1925. The single instance last year was the collision of June 15, at Welwyn Garden City, L.N.E.R. When, however, the number of casualties is considered, the favourable comparison with other years no longer holds. These numbered 13, and have been exceeded only on five occasions during the last twenty years—by the 17 passengers killed in 1934, 48 in 1928, 27 in 1927, 24 in 1924, and the 269 in the disastrous year 1915, when 224 were killed Quintinshill. There have been years—1934 was one—when a comparatively good record as to the accidents involving loss of life among passengers was marred by a bad record in the number of trainmen killed. That was not the case in 1935. Until Colonel Mount's annual report is out later in the year we shall not know the actual figures, but our memory suggests that there were only three trainmen killed in train accidents last year—one in each of those at Hazlewood, February 20; Ashton-under-Hill, February 25; and King's Langley, March 13.

* * * *

High Speed and the Permanent Way

That railway engineers have been keeping abreast of the development of higher speeds on railways was illustrated by Mr. W. K. Wallace's paper last night to the Railway Students' Association in London, and abstracted on page 76. In this country such sensational developments as the Silver Jubilee of the L.N.E.R., and the Bristolian of the G.W.R., not to mention the very fast L.M.S. expresses instituted a year or so ago, have been possible without any special preparation on the part of the permanent way engineer. Already our main lines were in good enough condition to sustain such traffic. This is due to the improvement in permanent way maintenance developed, particularly in the last decade, along the lines of improved ballasting and drainage, and the more careful alignment of the track. In other countries the permanent way engineer has similarly kept well ahead of the requirements of the traffic department. Particularly is this so in France and Germany, the permanent way of which countries is now in a condition to sustain the requirements of the traffic up to the limits of practicable locomotive power. In the U.S.A. a certain amount of final improvement has been called for to cope with the high speed train now running on the competitive lines between Chicago and the Twin Cities, but generally the increased speeds that have been introduced in the States in the last year or two have not called for anything beyond the normal improvement of ballasting, drainage and alignment that is being pursued almost everywhere on main lines today.

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Proposed Calcutta-Saugur Railway, 1835

Though no railway was opened for traffic in India until 18 years later, it is remarkable that as early as 1835, a line between Calcutta and the mouth of the Hoogli was seriously considered, as a link in the chain between London and Calcutta. This fact is elaborated—as quoted elsewhere in this issue—in the first volume of our constituent, the original *Railway Magazine*, the issue being that of January, 1836. Known as the Calcutta and Saugur Railway and Harbour scheme it was to have been carried out by a company of that name, and included (1) the building of a new harbour at Thackery's Creek upon Lacam's Channel—which forms one of the mouths of the Hoogli separated by Saugur and Clive's Islands from the main channel—and (2) the construction of a railway from Calcutta to the harbour, a distance of 47 miles, with a branch to Diamond Harbour. A saving of time in the transit of passengers and mails of 16 to 18 hours was anticipated, and the great dangers of the navigation of the Hoogli were to be avoided. We seem to remember that at the beginning of the present century the principle of this scheme was still being followed, in that the English mails from Burma were landed at Diamond Harbour and sent by train to Calcutta, but we stand open to correction upon this point.

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Automatic Couplings

During a recent visit to Poland we noticed particularly the working of the heavy coal trains between Silesia and the new Baltic port of Gdynia. These trains, loading up to 2,000 tons and hauled by powerful 2-10-0 locomotives, are equipped with continuous brakes, as indeed are most goods trains in Poland now. We ventured to congratulate a Polish State Railways officer of our acquaintance upon this, but, to our surprise, he expressed something like envy of the British railways in not having committed themselves unconditionally to the continuous braking of goods trains. He agreed with us as to the obvious advantages in the better control of trains so fitted, but pointed out a factor seldom thought of in this connection, namely the much greater difficulty in coupling up trains fitted with continuous brakes and the more arduous work it throws upon the shunters. Our immediate reply, of course, was that the final solution of the problem was to be found in a really effective automatic coupler which should couple up all the various connections required for the train. The installation of such couplings would, of course, be an expensive matter, but if only this initial outlay could be faced the ultimate economy would be important. In this connection it may be recalled that in our issue of December 27 we illustrated on page 1104 a coal wagon used in Germany fitted with the Scharfenberg coupling, which is now being fairly extensively used in that country, particularly for high-speed streamlined vehicles.

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More Big Engines for South Africa

In THE RAILWAY GAZETTE of November 15, 1935, we illustrated and described some very large 4-6-2 express locomotives built by Henschel & Sohn of Kassel and recently introduced on the railways of the Union of South Africa. Since then some similarly large and well designed engines having the 4-8-2 wheel arrangement have been completed at the works of Robert Stephenson & Co. Ltd., Darlington, for the same railway system. These are intended for working heavy passenger and freight trains, and have the distinction of being the largest 4-8-2 engines so far introduced for service on the South African Railways. On pages 64-66 of this issue we give details regarding these locomotives, and the illustrations therewith show that they combine an attractive appearance with an impression of power and efficiency. It is of interest to compare the characteristics of these locomotives with those of the 15 CA class of the same wheel arrangement, but differing in the respects shown in the comparative table included with the article. Although both the 4-6-2 and 4-8-2 engines operate on the 3-ft. 6-in. gauge, they are of proportions which would be considered outstanding for the 4-ft. 8½-in. or even a wider gauge. This is fully demonstrated by some of the leading dimensions, *i.e.*, cylinders 24 in. by 28 in., a total heating surface of over 4,000 sq. ft., and a weight in working order of nearly 174 tons. We think that the Chief Mechanical Engineer, Mr. A. G. Watson, is to be congratulated on both classes of engines, and it is possible already to report that preliminary trials have shown their performance to be fully up to expectations.

British Railways in 1935: A Retrospect

DURING the past twelve months the British railways have made efforts to anticipate the requirements of the travelling and trading public and are able to record an increase of gross receipts from each of the main branches of railway working. The passenger train earnings of the four group companies showed the largest increase over 1934, namely, £1,184,000, while general merchandise receipts rose by £236,500 and mineral traffics by £130,500. The total gross increase was therefore £1,551,000 or 1·04 per cent. over the previous twelve months. It should be borne in mind, however, that the total railway receipts are still over £30,000,000 below those of 1929, while the additional earnings will be largely offset by the part restoration of the wage deduction imposed in 1931, estimated to cost the companies about £1,100,000 during the year. Moreover, operating costs rose owing to the necessity for providing additional services for the extra traffic which has been secured. On the passenger side, widespread accelerations in train services have been effected and connections improved throughout the country, while timekeeping generally has reached a very high standard. Notable among the accelerations is the regular daily service introduced in September by the L.N.E.R. Silver Jubilee streamlined train which accomplishes the journey between London and Newcastle (268 miles) at 67·1 m.p.h. Another fine performance is that of the Scarborough Flyer in running from London to Scarborough in 4 hr. 5 min. On the Great Western Railway, the Cheltenham Flyer with its daily start to stop average speed of 71·4 m.p.h. from Swindon to London, has now accomplished its 1,000th run and maintained its schedule with remarkable consistency, while, to celebrate that company's centenary, The Bristolian was introduced on August 31 to give a daily schedule of 105 min. between London and Bristol, an average overall speed of 67·6 m.p.h. The L.M.S.R. has also effected important accelerations in many of its schedules, while the Southern Railway electrification has enabled considerably faster timings to be introduced to many coastal resorts. Steady improvements were effected in the design of passenger coaches with the object of increasing the amenities of travel, a particular example being the coaches constructed for the G.W.R. new Cornish Riviera Limited expresses.

Monthly return tickets again proved extremely popular, while there was a considerable increase in day and half-day excursion traffic. First class travel also showed a welcome improvement, attributable largely to the lower fares introduced for the cheaper varieties of tickets. Holiday season or " run-about " tickets were extensively purchased, while former innovations such as cruising trains, land cruises, ramblers' and hikers' trips, combined rail and river, and rail-road-river trips were largely developed. Camping coach holidays were surprisingly well patronised and an unlimited variety of day, half-day and evening excursions were run. Further co-ordination was effected between rail and bus services, and the air services operated by the companies through the medium of Railway Air Services Limited were extended and additional business secured. In connection with parcels traffic, a reduced and simplified scale of rates was introduced for packages up to 15 lb. conveyed at owner's risk and certain adjustments made for parcels weighing 16-18 lb. On the freight side, accelerations were effected in train services and delivery is now given with regularity on the morning following despatch between the majority of the important towns throughout the country. The number of consignments registered under the Green Arrow system constituted a record, while the railway cash-on-delivery service and insurance facilities for livestock were increasingly used by traders. Many more containers were put into service for particular types of traffic, collection and delivery services were extended and improved, and further co-ordination effected with the activities of Carter Paterson & Co. Ltd. and Pickfords Limited. Steady progress was also made in the co-ordination of the staffs, terminal facilities and town offices of the companies, while improved shed, warehouse and siding accommodation was provided at many places. A growing business was accomplished in household removals, while the special arrangements made for the expeditious conveyance of seasonable, perishable and motor-car traffic proved of material assistance to the traders concerned.

So far as legal and parliamentary matters are concerned, the Railway Rates Tribunal, after conducting its annual review of standard and exceptional charges, again reported that the railways were being conducted with efficient and economical management. The year closed, however, without any decision being reached in a question which vitally affects the future financial position of the companies, namely, that of rating. Early in the year the Railway & Canal Commission overruled the decision of the Railway Assessment Authority on the question of the rating of the Southern Railway. The commission determined the net annual value of the Southern Railway Company's hereditaments for rating purposes at £1,077,131 as compared with the sum of £2,180,000 fixed by the authority. An appeal lodged by the latter against the decision of the commission was heard towards the end of the year by the House of Lords, but judgment was reserved and has not yet been delivered. With the support of the Government, two large improvement schemes were begun: a £35,000,000 programme for the improvement of London suburban traffic facilities by the London Passenger Transport Board, the L.N.E.R., the G.W.R.; and a £30,000,000 scheme to be undertaken by the four main line companies, comprising extensive electrification and the reconstruction and modernisation of railway property, plant, and equipment. The completion of these works, in conjunction with those previously carried out under the Development (Loan Guarantees & Grants) Act, 1929, will facilitate and improve the efficiency of railway operation.

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The Production of Work-Hardening Rails

IN the discussion on the paper entitled " Steel Rails," which was read before the Institution of Civil Engineers by Messrs. E. F. Law and Vernon Harbord in 1934, the excellent wearing properties of the rails manufactured during the earlier decades of steelmaking came under review, as they generally do when comparison is made between past and present, and, as has been frequently suggested in previous articles which have appeared in *The Railway Engineer*, these results were attributed in large measure to work-hardening. The relatively light-wearing conditions to which these former rails were subjected in the earlier years of their life minimised the risks of fracture through brittleness, notwithstanding the fact that they contained percentages of certain harmful elements which would be completely outside present specification limits. These early rails were thus given the opportunity of gradually work-hardening under the rolling loads, until they were provided with a tough protective layer to the wearing part of the head which has resulted, in some cases, in a life of phenomenal length. The search in recent years after a better-wearing rail steel has therefore, in effect, been to produce a steel which will similarly be so much in advance of present-day traffic conditions as will enable it also to work-harden in the early stages of its life in the

track. During the past thirty years axle-loads, train-loads, and speeds have increased out of all proportion to the wearing capacity of the rails, and this has complicated the problem, as resistance to brittleness on impact is now a factor in deciding the analysis of the steel which may be worked to with safety. The search for better wear has proceeded along three different lines. There has first of all been the remodelling of the B.S. bull-head rail analysis, by reduction of the carbon percentage and the raising of the manganese percentage, which has produced the so-called medium manganese analysis, containing from 0·90 to 1·20 per cent. manganese. That this has better work-hardening properties than the high carbon analysis previously standard is proved by the increase in life which has been noted in wear comparisons of the two qualities, and which has resulted in the standardisation of the medium manganese analysis by the railways of Great Britain. But such an increase as this touches only the fringe of the problem. The introduction of alloying elements such as chromium has been another method of approach, but with the uncertainty of result which has attended their use, it cannot be said that alloys have yet provided a final solution. Manganese, used as an alloy up to 12 or 14 per cent., has produced a rail steel with some of the most remarkable work-hardening properties yet known, but here a cost to the user which is from four to six times that of ordinary rail steel has militated against any general adoption.

The third line of development has been that of heat treatment. Various methods of heat-treating the heads of railway rails have been evolved, on the Continent as well as in Great Britain, but this country can claim the origin of the most widely used of all these treatments. It is the Sandberg Sorbitic process, which is the subject of an article on pp. 56-63 of this issue, and by which approximately 200,000 tons of rails have been heat-treated to date. There are several advantages attaching to a heat treatment of this description. By the treatment, a hardened and greatly toughened exterior—reproducing in its properties the work-hardened casing of the early steel rails—is provided for the rail-head, while the web and the foot remain in the untreated condition. Although alloy steels, such as chromium, can be and are treated, the great majority of sorbitised rails are from standard analyses, in which no variation is needed. But perhaps the most important feature of the Regulated Sorbitic treatment, as now applied, is the high yield stress of the steel in the sorbitised rail-head. A tensile test taken from the side of the head, with its centre $\frac{7}{16}$-in. below the running surface, which may be expected to give an ultimate stress of 60 to 65 tons per sq. in., will frequently give a yield that is as much as 75 per cent. of the breaking stress, with rails so sorbitised. In the zone immediately under the rail-head, at a depth of about $\frac{1}{8}$-in. below the surface, tensometer or miniature tensile tests, which show an ultimate strength of 69 to 77 tons per sq. in., are now giving yield stresses of from 60 to 66 tons per sq. in., which are probably the highest yet reached here with any description of rail steel, whether heat-treated steel, alloy steel, or a combination of both. These very high tensile stresses are associated with elongation percentages of 15 to 11·5 per cent., so that in the zone where the treatment has been the most drastic, there is still more than adequate ductility. Morever, it is the general practice, when applying the falling weight test to regulated sorbitic rails, after the specified blow or blows have been given on the head of the test-length of rail, to reverse the rail on the supports, and subject the foot to one or two further blows, which are invariably sustained without fracture, so proving that this exceptional toughening of the head has in no way impaired the resistance of the rail to shock.

It is well known that no physical test on steel that has yet been devised, nor combination of tests, gives a complete and accurate measure of the resistance of that steel to the complex punishment to which the rail is subject when in service, from the joint effects of abrasion, pounding, contraflexure and reversals of stress, and other deleterious factors. But opinion among metallurgists tends in the direction of the yield point of steel as affording some indication of its probable resistance to these wear-producing stresses. Wear, in effect, is the violent breaking-up into minute fragments of the wearing surface of the steel, as a result of the passage of the rolling loads, and the more the structure of the steel can be improved with a view to resisting this disruption, so proportionately the life of the rail will be increased. There is thus good reason to believe that the regulated sorbitic treatment for rails represents a substantial step towards a better-wearing steel, and that this is strikingly indicated by the exceptional yield stresses to which attention has just been drawn, which may also be regarded as indicating better resistance to battering or deformation of the rails. Another fact of importance which emerges in the article is the exactness of control which is obtained in the modern application of the Sandberg Regulated Sorbitic treatment, which is witnessed to by the uniformity of the physical tests on the sorbitised rails.

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Australian Commonwealth Railways

EARNINGS of the Australian Commonwealth Railways for the year ended June 30, 1935, were on the whole £15,730 higher than for the previous year, as each system showed an increase except the Central Australia. Working expenses also advanced to the extent of £3,500, and the loss on working as a whole was £12,230 lower, at £33,983. The Trans-Australian Railway this time showed a profit on working of £19,887, compared with a loss of £12,301 in 1933-34, but the expenditure on this railway was exclusive of £151,700 for sleeper renewals from funds specially provided by the Treasury. On the Federal Territory Railway there was again a profit (£215 against £358), and on the North Australia Railway, which is an isolated system, the loss was reduced from £11,786 to £3,711.

	Earnings		Working Expenses	
	1934–35	1933–34	1934–35	1933–34
	£	£	£	£
Trans-Australian Railway (Port Augusta-Kalgoorlie, 1,051 miles 68 ch. 4 ft. 8½ in. gauge).	217,758	206,205	197,871	218,506
Central Australia Railway (Port Augusta-Alice Springs, 771 miles 33 ch. 3 ft. 6 in. gauge.)	83,522	90,566	133,896	113,050
North Australia Railway (Darwin-Birdum, 316 miles 40 ch. 3 ft. 6 in. gauge.)	38,273	27,907	41,984	39,693
Federal Territory Railway (Queanbeyan-Canberra, 4 miles 75 ch. 4 ft. 8½ in. gauge.)	6,132	5,277	5,917	4,919
Total, 2,144 miles 56 ch.	345,685	329,955	379,668	376,168

The increase from £22,484 to £50,374 in the loss on the Central Australia Railway was due to a fall in livestock traffic and to increased expenditure on replacement of sleepers and other special maintenance. The number of through passengers on the Trans-Australian Railway showed an increase on the previous year of 31·6 per cent.

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

The Fastest Train in Great Britain

St. Mary's Mansions, W.2. December 28, 1935

To the Editor of The Railway Gazette

Sir,—I was very pleased to see Mr. Cecil J. Allen's letter, and your editorial comments on it, in the December 27 issue. But although I quite appreciate all that has been said about the intermediate booked speeds and the relative tasks of the two trains concerned, all "fastest train" claims should now, in my opinion, be based on throughout-journey speeds only (inclusive of stops, if any), so that the Silver Jubilee, with its 67·1 m.p.h. average between London and Newcastle, must rank second in Great Britain to the Great Western's down Bristolian, with its journey-speed of 67·6 m.p.h. I do not overlook the hardship which this limitation would impose—trains like the 11.15 and 1.15 from Paddington losing place on the list by their continuation from Bristol to Weston-super-Mare—but none the less the rule seems to me both fair and necessary, the more so because we have lately had examples of high-speed claims based mainly on intermediate accelerations which do not affect the throughout speed of the train and do not benefit the public.

In a second category of "fastest booked runs" or "highest start-to-stop speeds" (which would, of course, be irrespective of distance or of the throughout journey-speed of the train) the Cheltenham Flyer still stands supreme in Great Britain, and is now followed by the Silver Jubilee's 70·3 Darlington and London average. This second list would remove any apparent unfairness in the conditions governing the list of "fastest trains," as here would be included all the "exhibition" performances (the word is not used in a derogatory sense) now scattered all over British and Continental timetables, though I admit of course that the actual merit of any particular train's performance would not necessarily be determined by its position on either list.

Test and demonstration runs, however great their academic interest and value, have no real bearing on these speed claims, and, in my view, intermediate working-book times—whether "pass to pass," "pass to stop" or "start to pass"—should also be ignored. They are not generally made public and, if they were admitted, not only would the compilation of an accurate list of highest booked speeds be extremely difficult, but some very peculiar and unjustifiable claims would have to be considered. For "working times," although based far more accurately on actual performance than they were at the beginning of the century, still tend in some cases to be counsels of perfection, and must occasionally be "manipulated" to avoid paper "clashings" *en route*. All high-speed claims should really be based on "public" times (where a discrepancy exists, for operating reasons, between the "working" and the advertised public departure) and speeds calculated on "working book" departures from stations where a train is booked only to "set down" (and can consequently start as soon as its work is completed) should, strictly, be excluded.

May I, in conclusion, echo Mr. Allen's tribute to the extent of our indebtedness, as regards passenger train speeds, to the Great Western Railway? It is not always realised that the press announcement made from Paddington in the summer of 1921—that in the following autumn all pre-war Great Western schedules would be restored—did more than anything else to expedite post-war speed recovery in Great Britain, just as the Great Western accelerations of 1898-1900 really started the speed-wave of the first five years of the century.

Yours faithfully,

R. E. CHARLEWOOD

[Argument could continue at great length as to what actually constitutes the final claim to speed supremacy. The fact nevertheless remains that at present the Silver Jubilee of the L.N.E.R. is the only express in Great Britain of which the schedule demands *average* speeds of 90 m.p.h. over considerable stretches of line, and sustained speeds of 70 m.p.h. and over up lengthy 1 in 200 gradients, whilst the G.W.R. has the fastest start-to-stop run.—Ed., *R.G.*]

Aveling & Porter Locomotives

Abbey House, S.W.1. January 2

To the Editor of The Railway Gazette

Sir,—I was interested to see that you published in your correspondence columns of December 20 an illustration of an Aveling & Porter gear-driven locomotive of 1899 which is still working in the sidings of Aveling-Barford Limited at Grantham. We have a similar machine, built in 1906, in service at our works at Leiston, and the following particulars regarding it may be of interest. It will be noticed that the engine works on the compound principle:—

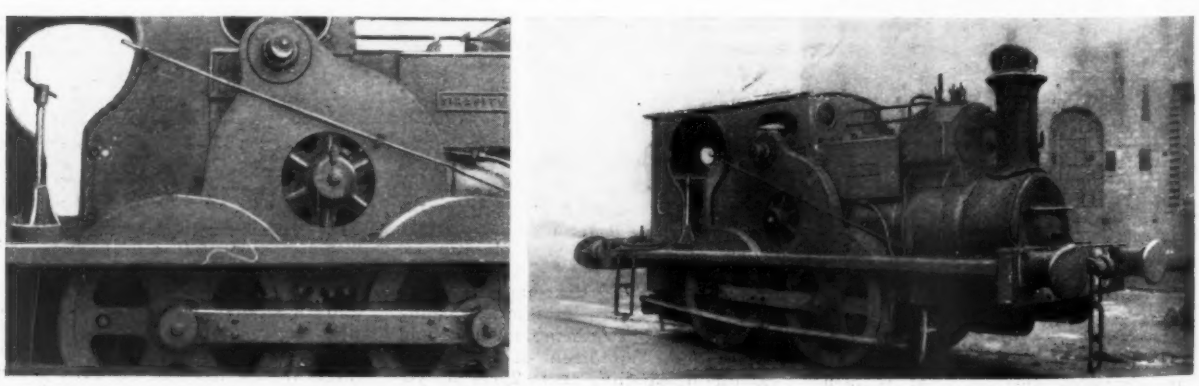
Cylinder (h.p.)	10 in. dia. × 14 in. stroke
,, (l.p.)	16¼ in. dia. × 14 in. stroke
Driving wheels	4 ft. dia.
Wheelbase	5 ft. 0⅝ in.
Gauge	4 ft. 8½ in.
Flywheel	4 ft. dia.
Normal speed (crankshaft, 130 r.p.m.)	5·6 m.p.h.
Tractive effort at normal speed	92 b.h.p.
Boiler pressure	180 lb. per sq. in.
Grate area	8·75 sq. ft.
Heating surface	257 sq. ft.
Boiler tubes (100)	1¾ in. dia., 5 ft. long

The engine carries 217 gall. of water and 7½ cwt. of coal; it is fitted with two injectors, and with governors. It may be pointed out that what appear in the illustrations to be connecting rods are actually stays between the axles.

Yours faithfully,

W. CYRIL WILLIAMS

Director, Richard Garrett Engineering Works Ltd.



Transmission (left) and general view (right) of Aveling & Porter geared compound locomotive "Sirapite"

PUBLICATIONS RECEIVED

Investor's Pocket List of Reference Tables, 1936. London: Fredk. C. Mathieson & Sons, 16, Copthall Avenue, E.C.2. 6½ in. × 3½ in. 14 pp. Limp cloth. Price 1s.—Investors will find in this handy list a variety of useful information. A perpetual yield table, a table for calculating yields on £1 shares, stamp duties on transfers and contract notes, income tax at 4s. 6d. in the £, income tax for investors, dividend and interest table for £1, 10s. and 2s. shares, official minimum scale of brokers' commissions, &c., which are given in the list, form a valuable guide to Stock Exchange transactions. Other interesting items in the list are the rates of income tax for each year from 1879 onwards, and Bank of England changes in minimum rates of discount since 1912.

Les Postes d'Aiguillage Electrodynamiques de la Compagnie des Chemins de fer Paris-Lyon-Mèditerranée (The Electric Power Signalling Installations of the P.L.M. Railway). By Jean Boillot. Paris: Compagnie Française Thomson-Houston, 99-101 Rue Leblanc. 8 in. × 10¾ in. 50 pp, 33 figures (photos. and diagrams).—This well-produced booklet gives a concise and instructive account of the development of power signalling on the P.L.M. Railway, beginning with the trials made in 1898 in the neighbourhood of Paris with the Rodary type point and signal machines, and the adoption of power frames on the individual lever system at Villeneuve-St. Georges and elsewhere; it is explained how the route-lever apparatus of Bleynie and Ducousso came to supersede them as the company's standard for new work. Cabins on this system have been installed at Melun, Dijon, Lyons, and finally at Paris, where a very large plant, involving all the improvements suggested by experience, was completed in 1934, replacing one of the longest Saxby mechanical frames (containing 200 levers) in France. Monsieur Boillot describes each part of the equipment in detail, point and signal machines, light signals, the mechanical "combiner" or route-lever frame, the circuits for the various functions, track locking and the general layout of the two cabins at the Gare de Lyon, Paris, actually housed in one building. The advantages of route-lever operation for this kind of work are clearly brought out and the various classes of movement controlled from the new frames studied step by step with numerous diagrams. The stages followed in the process of resignalling this large terminus, where eight incoming lines, excluding siding and engine lines, develop into twenty-one platform lines and three siding bays, as well as in the rearranging of the permanent way, are also explained. The whole gives an admirable idea of what is being accomplished in France today in this important branch of railway engineering, and of the manner in which the route-lever principle is being applied to simplify the work of the signalmen.

The Book of Speed. New Edition. London: B. T. Batsford Limited., 15, North Audley Street, W.1. 10 in. × 7¾ in. × 1 in. 160 pp. Price 5s. 0d. net.—Developments in 1935, and the gratifying welcome accorded to it on its first appearance, have led to a new edition of "The Book of Speed" being published this year. The original text and pictures are retained, but there is a supplementary article by Mr. Barré Lyndon, which brings the record of speed achievements as far up to date as the exigencies of publication permit. The exploits of the L.N.E.R. Pacific *Papyrus*, on March 5 last, are the most recent railway performances to which reference has been possible, and Mr. Lyndon seems to us to treat them with rather scant courtesy when he merely remarks that a speed of 108 m.p.h. was reached on a journey from London to Newcastle (instead of on one from Newcastle to London), and also implies that the record was set up at some date later than June. The facts seem to have been somewhat hastily examined, and then inserted out of their due order by an author impatient to enlarge upon motor-racing achievements. Fear of the accusation of prejudice forbids us to enlarge upon the fact that however meritorious these may have been, and however well they deserve the disproportionate space (as it seems to us) allotted to them, theirs is not the type of speed which the author eulogises on the grounds that it adds something "to leisure and to life."

Readers seeking a less jaundiced view of the book as a whole may be referred to our review of the first edition in our issue of December 14, 1934. Of the illustrations added this year it can be said that they are reproduced no less effectively than those of the original version, though somewhat less striking in their composition. We would also anticipate the cry of a thousand well-informed schoolboys by pointing out that the partly streamlined G.W.R. "King" class engine described in a caption as "travelling at speed" (to which impression the fact that the view is taken broadside contributes) is carrying a slow train headcode.

Scrapers, Excavators, and Thickening Plant.—Three illustrated booklets received from International Combustion Limited, Aldwych House, Aldwych, W.C.2, deal respectively with cable drag scrapers, slackline cableway excavators, and thickeners. The scrapers are also applicable to conveying materials into and out of storage, while for excavating they are suitable for dealing with high banks or removing hills and overburden. Equipment of this type is capable of handling up to 2,000 cu. yd. a day. The slackline cableway excavator is particularly suitable for working in pits or under water; the relative advantages of both types are fully outlined in these informative and practical booklets. The third booklet describes the Hardinge thickener, which will thicken automatically and continuously chemical, metallurgical, and other pulps or slurries, and washing soluble salts, either acid or alkaline, from finely divided solids.

L.N.E.R. Tide Tables.—The tide tables for 1936 have been issued by the L.N.E.R. and may be obtained free from the portmaster at the port concerned. The tables are bound in four columns of a handy size for the pocket and contain information regarding high tides, depth of water, phases of the moon, and accommodation available at the various docks. The volumes deal respectively with: Middlesbrough Dock; Tyne Dock and Dunston Staithes; the Hartlepools; and Hull, Immingham, and Grimsby.

London School of Hygiene and Tropical Medicine.—We have received from the school two booklets, one of which deals with the report by the Dean on the work of the school for the year ended July 31, 1935, and contains some interesting information on such matters as bacteriology, chemistry as applied to hygiene, industrial psychology, and public health. The second booklet is the Eleventh Annual Report to the Court of Governors, 1934-35. It includes a lengthy list of donations and subscriptions and a photograph of the school itself.

Egypt, Palestine, Iraq, Syria.—"Thrift" tours to Egypt and Palestine are a feature of a new booklet issued by the Cook-Wagon Lits World Travel Service, Berkeley Street, London, W.1. By these arrangements a holiday of from 24 days, with a stay in Cairo, can be enjoyed for an inclusive fare of £31 5s., while for £41 10s. the itinerary is extended to include a period in Jerusalem. Longer tours are also quoted for, and the booklet gives timetables both for the overland route to Palestine and Egypt via the Simplon-Orient Express and its connections, and of Pullman, dining, and sleeping car trains between Alexandria, Cairo, Haifa, and Jerusalem.

Air Filters.—The filtration of air in ventilating systems of all types is provided for by the unit type oil film filters described in a new catalogue which we have received from James Keith & Blackman Co. Ltd., 27, Farringdon Avenue, E.C.4. Each unit is complete in itself, and capable of filtering 750 cu. ft. of air per min. Panels of filters may be built up to any required size, without the use of special framing unless under exceptional conditions. For filtering air charged with exceptionally fine or sooty dust a series of dry cell filters is supplied, and these, like the oil film type, can be bolted together to form large panels without the use of framing. Oil film filters are also made in a circular pattern for attaching to the inlets of blowers, exhausters, and air or gas compressors.

THE SCRAP HEAP

The longest ticket ever issued to a passenger by the Canadian National Railways was recently sold to a woman making a lecture tour of Western Canada. As each stopping place necessitates a separate coupon, a 6½-ft. strip was needed to cover the entire trip.

* * *

In 1845 during the discussions on a Midland Railway Bill before the House of Commons, Mr. Hill, the Counsel, was addressing the Committee, when Sir John Ray Reid, who was a member of it, handed the following lines to the chairman:—

Ye railway men, who mountains lower,
Who level rocks and valleys fill;
Who thro' the *hills* vast tunnels *bore*;
Must now in turn be *bored* by *Hill*.

* * *

There passed away at Monkseaton on November 27 at the ripe old age of 83, Mr. Robert Handcock, the inventor of the Handcock anti-coal-breaker, which is now in use at a number of shipping points as a means of reducing the breakage of coal during shipment. One of the happiest moments in Mr. Handcock's life was on April 9, 1934, when, after being present at a demonstration of the latest form of Handcock anti-coal-breaker at Hull, he was introduced to a gathering of colliery owners and exporters at the Hull Guildhall. Mr. Handcock had an inventive mind and, after passing the four score mark, was busy in his leisure time on an appliance for regulating the flow of coal during shipment through gravity spouts.—*From the "L.N.E.R. Magazine."*

* * *

"You can keep your brain young by working it hard. It grows in power with use. The only thing that grows old about a man is his body. If my stomach holds out, I'll be inventing new things at 100."—*Thomas A. Edison, speaking at the age of 82.*

* * *

HORSE DETONATES FOG SIGNAL

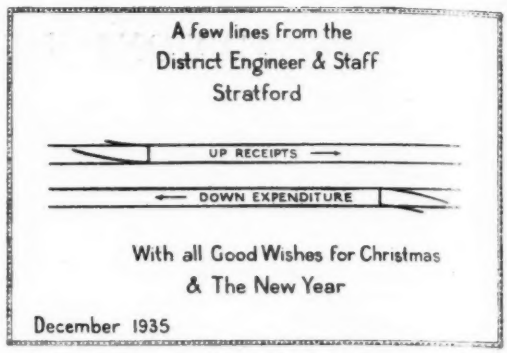
Recently the Superintendent of Carter, Paterson & Co. Ltd. at Tottenham made the following report to the head office of the firm:—

Enclosed, part of exploded fog signal. This was detonated by one of our horses attached to 37 District Van, treading on it in Boundary Road, Walthamstow, yesterday, Wednesday evening. Happily, Carman Banks was able to keep control of his pair of horses and no damage was done. This is a most unusual occurrence and I think you will probably like to know of it.

* * *

POSTERS PREFERRED TO HISTORY

Watford (Herts) School Managers have asked the County Council to substitute railway posters for fourteen historical pictures hanging on the walls of Callow Land Junior Boys' School. They say the posters are "real art" and would brighten the classrooms and be more suitable than the pictures in use at present.—*From a recent issue of the "News Chronicle."*



Novel greeting card from the L.N.E.R., Stratford

One Hundred Years Ago

Extracts from the January, 1836, issue of "The Railway Magazine" (afterwards "Herapath's Railway Journal") and the oldest constituent of THE RAILWAY GAZETTE

EMPLOYMENT OFFERED BY RAILWAYS.—The average number of persons daily employed on the works of the London and Greenwich Railway during the last year is 554, exclusive of the brick-makers, lime burners, bargemen, iron-founders, persons pulling down houses, clerks of the works, police, collectors, &c.

DUBLIN & KINGSTOWN RAILWAY.—Yesterday being the anniversary* of the opening of the Dublin & Kingstown Railway was observed as a gala. The following are the results of the first working year ending on Wednesday last:—

Total receipts £31,066 8s. 6d.

Number of passengers, exclusive of annual subscribers	1,068,018
Number of trips by the locomotive machines	22,050
Number of miles travelled	125,275

No accident had occurred to any single individual during the whole year.—*Dublin Evening Mail.*

NEWCASTLE & CARLISLE RAILWAY.—The 600 quarter shares in the Newcastle & Carlisle Railway Company being those above the number set apart for the original shareholders, were all tendered for, and sold at par, on Tuesday sennight. None can now be obtained, except at a premium of £1 per quarter share.—*Durham Chronicle, December 11.*

* The Dublin & Kingstown Railway was opened to public traffic on December 17, 1834.

GREAT NORTH OF ENGLAND RAILWAY.—We have been informed that upwards of one hundred shares in this stupendous national undertaking have been disposed of to parties residing in this town; the sums thus subscribed amounting to upwards of ten thousand pounds.—*Sunderland Herald.*

RAILROAD FROM NUREMBERG TO FURTH.—In the morning of December 7, at 9 o'clock, the iron railroad from Nuremberg to Furth was opened in the manner named in the programme. M. Binder, the chief burgomaster, opened the ceremony with an address, while the band of the Regiment Landwehr played the national hymn. The monumental stone was then uncovered, which has on one side the cipher of the King and the inscription *Deutschlands erste eisenbahn mit dampfkraft, 1835;* signifying "Germany's first iron railroad with steam power, 1835." On the other side are the united arms of the two towns, with the inscription *Nürnberg und Fürth.* After a short pause, the steam carriage, with nine carriages for passengers attached to it, all decorated with the national colours, set out for Furth, while countless multitudes of spectators were assembled along the road. The carriages traversed the road three times, and were always filled with passengers, the journey being made in fifteen minutes.

THE CALCUTTA AND SAUGUR RAILWAY AND HARBOUR.—Very great interest has been excited among all parties connected with, or interested in, our trade with India, exceeding in enterprise and usefulness even those important ones by which the last few years have been distinguished. An association denominated the Calcutta & Saugur Harbour Railway Company is in the course of formation, having for its object the connecting the important oriental mart of Calcutta, by a railroad, with the entrance of the Hoogly, thereby avoiding the perilous navigation of a river so fraught, as it is well known to be, with danger both to life and property. . . . A harbour is intended to be made at Thackery's Creek . . . from the harbour, a railroad to Calcutta will be constructed, a distance of about 47 miles, almost in a direct line, of a natural level.

(*See editorial note on page* 43)

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

SOUTH AFRICA

Financial Position

The results of working for the seven months April to October, show a surplus of £1,683,779 of revenue over expenditure after allowing for special appropriations of £466,666 to Betterment Fund, £284,083 deficiency in Pensions and Superannuation Funds, £583,333 Rates Equalisation Fund, and £233,334 to writing out of Capital Account discount and expenses on pre-Union capital. Revenue from transportation services only for the period totalled £17,048,889, an increase of £1,662,927 on the previous year. Railway working expenditure totalled £11,254,612, an increase of £716,817. Further revenue records are being created. In the last four weeks there have been successive increases. The total for the week ended December 14 reached £667,849, an increase of £84,374 over the corresponding week of last year.

INDIA

Megna Bridge Construction

The inaugural ceremony in the construction of the Megna Bridge—which will consist of seven 323-ft. spans and six approach spans of 100 ft.—was recently performed by Mrs. F. J. Salberg, wife of the Chief Engineer, Assam Bengal Railway, when she placed the first batch of cement concrete in the first well curb of the foundations. While the party attending the ceremony visited the staff quarters, workshops and girder erection yard, the well curb was filled with cement concrete, and on the return of the party Miss Cuffe, daughter of the Agent of the Assam-Bengal Railway, broke a bottle of champagne over the well.

Mysore Railway Projected Road Service and Total Earnings

It is understood that the Mysore Government has decided to accept the recommendation of the Motor Transport Committee that the monopoly of bus services on roads in that State regarded as competitive, should be given to the railways. Arrangements are accordingly being made for the Railway Department of the Government of Mysore to initiate a road service on the Shimoga-Sagar road which runs parallel to the railway. To begin with there will probably be three diesel-engined buses and one lorry in this service.

The gross earnings of the Mysore State Railways for the year ended June, 1935, amounted to Rs. 31,54,000, being about a lakh below the figure for the previous year. The deficit is attributed to trade depression and road competition, the latter being responsible for a noticeable decline in passenger traffic.

Camping Facilities

In order to promote railway travel during the Christmas holidays the East Indian Railway administration is offering, in addition to the usual travel concession, to place at the disposal of shooting or camping parties one bogie carriage and a four-wheeler specially equipped with camp furniture, cutlery, crockery, cooking utensils and table linen. The bogie carriage provides accommodation for six persons and the four-wheeler for four. Both have separate servants' compartments, kitchens and bathrooms. Though not fitted with electric lights and fans, the carriages are adequately lit and contain swing punkhas. These carriages are not meant for travelling purposes except to move from one camping station to another within limitations. For this, actual second class fares plus third class fares for servants will be charged. The charges for the occupation of the carriages, the bogie for six persons being available for Rs. 10 (15s.) per diem and the four-wheeler for four persons costing Rs. 7/8 (11s. 3d.) per diem.

Indian Railway Policy

Sir T. R. Wynne's speech at the annual general meeting of the Bengal-Nagpur Railway has roused considerable interest in India and has been commented upon by most of the Indian newspapers. While business circles generally welcome his suggestion that the Indian railways should be free to quote rates below the prescribed minima if circumstances demand, many railway officials consider such latitude of doubtful benefit. The minimum for certain classes of traffic is already as low as 0·1 pie ($\frac{1}{120}$ d.) per maund (or roughly $\frac{1}{4}$d. per ton) per mile and is seldom in operation. In view of the present reduced railway earnings, it seems improbable that the railways will be tempted to come down even to the minimum permissible under the existing classification. There is one aspect of the situation, however, which should be borne in mind. As Sir Henry Burt recently remarked at the annual meeting of the Bengal Dooars Railway, road competition is being increasingly felt in the transport of both goods and passengers, and to combat increased competition in goods traffic, it is desirable that the railways should be armed to meet the situation with a prompt reduction of rates.

In regard to the centralisation of control in the Railway Board, it is generally felt that the very large financial interest of the Government of India in the Indian railways justifies a certain amount of control on the part of the Government.

RHODESIA

Improved Train Services

The new summer timetables, operating from December 2, have introduced several accelerated passenger train services of great benefit to the Rhodesian public. To the Union a new fast train leaving Bulawayo on Monday morning reduces the journey time to Johannesburg by over five hours, to Capetown by 11½ hours and to East London and Port Elizabeth by 16 hours, and as this train leaves Bulawayo seven hours earlier, the advantage is greater to passengers from the north and east, whose wait in Bulawayo is correspondingly reduced. Other accelerations on the Union service are cuts of 30 minutes in the time of the Rhodesia Express with the weekly overseas mail from Capetown and of 28 minutes off the run of the Rhodesia Limited to Capetown.

The earlier arrival of the Rhodesia Express permits earlier departures of the expresses to the Victoria Falls and the north by 75 min., and to Salisbury and Beira by 30 min. The other twice-weekly mail trains to the north are accelerated by 3¾ hours between Bulawayo and the Victoria Falls, while the return trains from Ndola to Bulawayo are accelerated by 1¾ and 6¼ hours respectively. On the Bulawayo-Salisbury service, Saturday mail train is speeded up by 5¼ hours, and certain other small improvements are made on branch lines.

ARGENTINA

The Railwaymen's Wage Bill

In continuation of the details given in the Overseas columns of THE RAILWAY GAZETTE of December 27 regarding the decline in passenger movement and receipts on the Argentine railways during the last 5 years, the following statistics relating to the increase in the salaries and wages bill, which represents such a large proportion—estimated in some cases at 75 per cent.—of the working expenses, may be of interest. According to comparative statistics furnished by the National Railway Board, the decline in traffic on most of the European and North American and other foreign railways has been generally offset by an equivalent decrease in the number of employees, with a corresponding reduction in salaries and wages. For example, in the United States between 1920 and 1934 the number of employees on the railways gradually decreased by about 51 per cent., and in the same period the amount of salaries and wages had fallen by 59 per cent. On the Canadian railways, the number of employees had been reduced between 1929 and 1931 by 18 per cent., and wages by 21 per cent. In Great Britain (to

quote the same authority) the number of employees had fallen between 1926 and 1935 by 16 per cent. In Germany the number had decreased by 16 per cent. between 1929 and 1932; and in Belgium, during the same period, the number had fallen by 24 per cent.

Reduction in Argentine Staff and Wages

The analysis proceeds to show that although the number of employees on the Argentine railways has been reduced, the proportion is much less. In 1929 the total number was 154,000, and in 1934 it was 131,000, a decrease of 15 per cent., the salaries and wages bill having been reduced in the same period from 309 million pesos per annum to approximately 254 millions, or 18 per cent. This reduction was, however, insufficient to compensate for the fall in the receipts which, during the same period, declined from 653 million pesos to 489 millions, a decrease of 25 per cent. It should also be noted that the average annual salary has gradually risen from $846 pesos in 1900 to $2,098 pesos in 1931 (the peak year), since when there has been a slight decline, the average in 1934 being $1,937 pesos, a decrease of 7·7 per cent. as compared with 1931. The appended table shows the increase in the number of employees and in salaries and wages on all the Argentine railways (exclusive of the provincial lines) in each quinquennial period from 1900 to 1925, and thereafter annually from 1929 to 1934:—

Year	No. of employees	Amount of salaries and wages $ paper	Average annual salary $ paper
1900 ...	43,486	36,780,000	846
1905 ...	61,215	57,287,000	936
1910 ...	107,162	119,576,000	1,116
1915 ...	117,066	123,811,000	1,058
1920 ...	129,103	204,549,000	1,584
1925 ...	135,031	242,864,000	1,799
1929 ...	154,365	308,509,000	1,999
1930 ...	148,717	303,184,000	2,039
1931 ...	137,134	287,692,000	2,098
1932 ...	138,006	275,902,000	1,999
1933 ...	134,755	261,183,000	1,938
1934 ...	131,231	254,238,000	1,937

At the present free rate of exchange the pound sterling is worth 18 pesos, the par rate being 11·45 pesos.

UNITED STATES

Federal Lending Body Favours Merger

The political elements opposed to railway amalgamation—for the most part, labour unions, vested interests in communities where railway workshops are located, and demagogic ranters against monopoly—were recently again agitated by a suggestion from the Reconstruction Finance Corporation's railroad division that the Missouri Pacific, the Missouri-Kansas-Texas and the St. Louis-San Francisco be amalgamated.

These railways serve the same general territory and are competitive at many points. Their amalgamation, consequently, would undoubtedly result in the concentration of traffic on the best of three parallel lines, reducing the others to a secondary status. Amalgamation of this kind is unquestionably needed to some degree at least if the American railways are to be able to confront a thoroughly modern highway competitor with the greatest efficiency of which the railway industry is capable. However, the vested interests in the *status quo* are so great, and so powerful politically, that to accomplish anything in this direction is going to be a difficult business.

Reconstruction Finance Corporation's Bold Suggestion

The temerity of the railway division of the Reconstruction Finance Corporation, in view of the fact that it is a semi-political body, in making a suggestion of such political unpopularity might be wondered at except for the personality of the head of that division, Mr. John Walker Barriger. Mr. Barriger was the author of the so-called "Prince" plan for amalgamation of all the railways into six or seven systems, which was urged on the Government in 1933. The Government feared the plan, but it was struck with the encyclopædic knowledge of American railways shown by Mr. Barriger and induced him to become the head of its railway division.

A Young and Vigorous Body

In this capacity he has had the supervision of £100,000,000 of Government loans to railways, and the task has not been taken lightly. He has gathered around him in the division a dozen assistants, mostly young and vigorous men, and this group has examined thoroughly all the workings of the railways which are indebted to the Government, or which would like to be. The railroad division has investigated in detail the degree of efficiency with which each of the departments of the debtor railways is conducted, with the result that probably nowhere in America—not even in the Interstate Commerce Commission—is there one office so conversant with the details of railway operations the country over. Not being vulnerable in its own efficiency, and hence relatively safe from attack, the railroad division has not hesitated to make known its views with respect to the necessity for amalgamation.

The Unions and Public Ownership

Not long ago the railway unions—or rather the chief executives of the unions, because there was no plebiscite among the membership—declared themselves in favour of public ownership of the railways, and have set up a press office in Washington directly opposite the Capitol to plump for it.

The reasons for the adoption of this policy are obvious. The Supreme Court disallowed the Pension Bill passed last year, and fears are entertained as to its attitude on the second Bill passed this year. The Constitution otherwise sets definite limits upon the extent to which legislators may encroach upon the rights of private property. Owing to the great number of votes the unions control, Congress will enact almost any legislation they dictate. On the other hand, if this legislation encroaches too far into the rights of railway owners, the Supreme Court will invalidate it. But if the railways were to become public property, presumably Congress could specify wages as high, hours as short and as many employees on each train as the unions might desire, and the Court could do nothing about it.

That is the reason behind the unions' espousal of public ownership, a fact which is generally recognised. Be it said to the credit of the rank and file of the membership of the unions, however, that their executives have not dared put this policy to a vote.

JAPAN

Streamlined Locomotives

The first of a batch of new streamlined locomotives will be put into service early in 1936. The authorities state that trial runs during December, 1935, have given highly satisfactory results. The locomotives are being built for the purpose of speeding up the express train schedules on the Tokyo-Kobe main line.

MANCHUKUO

Payments for Chinese Eastern Railway

The placing by the Russian Government of orders under the Chinese Eastern Railway Purchase Agreement, which stipulates part payments in goods to an extent of Y.93,300,000 (£5,450,000), have made substantial progress. According to a report issued by the Manchukuo Embassy in Tokyo, orders for the following goods have been placed up to November 30 last.

	Y.	£
Machinery of all kinds	17,013,000	(990,000)
Soya beans and bean cake	8,534,000	(500,000)
Ships	8,434,000	(490,000)
Copper wire and cables	7,545,000	(440,000)
Cement	5,709,000	(330,000)
Textile goods ...	5,610,000	(330,000)
Rope	5,219,000	(300,000)
Hoop iron	2,589,000	(150,000)
Tea	2,438,000	(150,000)
Flour	1,865,000	(110,000)
Rayon goods ...	1,592,000	(90,000)
Various other materials	6,516,000	(380,000)
Total value of orders placed	73,058,000	(4,260,000)

Of these orders goods to the value of Y.22,105,000 (£1,290,000) had been delivered up to the end of November. All orders have been placed with Japanese manufacturers, with the exception of those for soya beans and bean cake and a few small items which have been supplied by Manchukuo.

NORTHERN IRELAND

The Road Transport Board

The board entered upon the New Year with all the passenger services operating in the province under its control. This is in accordance with plan, and it will take over the remaining freight-carrying concerns at intervals. The board has now a fleet of 690 buses and 178 goods vehicles. The following services were taken over on January 1:—

Ballykinlar Service Garage, Ballykinlar, Co. Down.
Samuel Girvan, Ballyclare.
John Gaston, Belfast.
Frederick Johnston, Lisburn.
A. and J. Mallagh, Belfast.
McAllister & Co., Carrickfergus.
Denis McLarnon, Belfast.
Robert Owens, Belfast.
Jacob O'Neill, Bangor.
Samuel Pentland, Belfast.
A. W. Pithers, Newcastle, Co. Down.
Clem. Robinson, Larne.
William Sloan, Belfast.
William Stewart, Belfast.
Stewart Bros., Portrush.
Michael J. Sawey, Newcastle.

The entire road services hitherto operated in Northern Ireland by the Great Northern Railway are, of course, in the hands of the board.

IRISH FREE STATE

Great Northern Railway

Both the leading railway companies report a year of progress, and the Great Northern Railway has exercised the powers conferred upon Free State railways to acquire the road lorry services in its territory. Altogether 97 road merchandise licences have been taken over—33 of them jointly with the Great Southern Railways—and the company now operates 124 buses covering a route-mileage of 1,015, and 137 lorries, in the Free State.

During the past year 10 new main line coaches were built at Dundalk. These were the first coaches in Ireland with steel roofs and side panelling. [They were described in our issue of July 19 last.—ED. *R.G.*] Two additional third class buffet cars are also under construction. There have, moreover, been important developments in the use of diesel-engined railcars, notably between Dublin and Howth. Additional cars are now being built at Dundalk.

Great Southern Railways

During 1935, five new locomotives and two new steel-panelled corridor trains have been built at Inchicore. For road traffic 38 large buses, 12 coaches and 162 new Fordson six-wheel lorries were built. In all, some 230 road merchandise carrying businesses have now been transferred to this railway, and practically all road passenger services in its territory, omitting the Dublin area, are operated by it.

In addition to the complete closing of the Cork-Coachford-Donoughmore and Galway-Clifden branches, the Tralee-Fenit, Westport-Achill, Patrickswell-Charleville, and Cork-Macroom lines have been closed for passenger traffic and road services substituted.

HOLLAND

Economies on Netherlands Railways

The following are some of the economies that have been effected upon the Netherlands Railways of recent years: The number of districts has been reduced, as also has the number of departments at headquarters. By the replacement of highly-paid by lower-salaried personnel, and by the gradual reduction of staff, the wages bill has been materially reduced. This fact is strikingly illustrated by the table below (figures represent thousands of fl.):—

	1921	1934	Reduction
	£	£	£
Salaries	107,793	67,929	39,864
Contributions to staff funds	13,347	5,907	7,440
Cost of uniforms ...	2,448	480	1,968
Travelling expenses	2,120	939	1,181
	125,708	75,255	50,453

Miscellaneous sources of economy have been the closing of unprofitable lines, the discontinuation of passenger services, and the purchase of lines being run for the benefit of a third party. Passenger services have now been closed on 221 km. of line in different parts of the country, and 324 km. have been entirely closed.

Electrification and the introduction of diesel railcars, though they have increased the train services, have been responsible for considerable economy, especially in train staff wages. The goods train staff has also been reduced as a result of the introduction of the Kunze-Knorr compressed air brake on these trains a year ago.

Simplified Wagon Control

A simplified system of wagon control has made possible a reduction of staff at 65 stations. In addition, the institution of distributing centres for less-than-full-wagon-load trains, between which centres fast non-stop trains are run, and from each of which distribution is undertaken throughout its own area, has resulted in faster running and quicker delivery, abolition of transhipment, reduction of train-mileage and more rapid turn round of stock. Since October a similar system has been in force for full-wagon-load traffic. Locotractors (motor shunting engines) and ticket issuing and printing machines have also materially reduced station working expenses. These and other measures have secured an aggregate saving in station staff of 5,000 men since 1922.

On lines still open, 120 stations have been closed for goods, and 90 for passenger traffic. Meanwhile maintenance and signalling charges have been curtailed by the abolition of level crossings, reduction in permanent way staff and inspection lengths (from 115 to 94), the introduction of train control, the standardisation of permanent way material, the abolition of electric power stations, the introduction of automatic telephones and the mechanisation of office accounting, &c. These measures have made possible a reduction in personnel of 5,800.

Modernisation of the steam locomotive stock, reduction (from 79 to 46) in the number of locomotive depots and their improvement, and centralisation of repair work have produced a fall in traction costs from fl.80 to fl.41·40 per train-km. between 1924 and 1934. Electrification is now in force on 199 route km. of line, and there are 97 internal-combustion shunting engines (locotractors) in service and 8 on order. A 10 per cent. all-round average reduction in weight of passenger and goods stock has been secured by the use of lighter materials and improved construction methods and design, and air-resistance has also been diminished. There are now over 2,150 fewer employees in the Running Department than there were in 1921.

Centralisation of Repairs

The centralisation of locomotive repairs at Tilburg and Zwolle, of those for coaching stock at Haarlem and Utrecht, and of those for wagon stock at Amersfoort and Blerick has reduced the average time of repairing a locomotive by 63 per cent., a carriage by 53 per cent., and a wagon by 33 per cent. Repairs of special parts of all stock have been concentrated at Utrecht. The net result is that though the train-kilometreage has increased since 1921 by 24 per cent., repair costs have fallen by 42 per cent., and the number of workshop hands has fallen by 2,500.

FRANCE

Wine Transport Tariffs

Early last year the French Government made use of special powers, under the convention of 1921, to impose a temporary reduction of 33 per cent. and later of 25 per cent. in the railway freight rates for the transport of wine. Owing to continued trade depression, the Government requested the railways to extend the reduction for six months in 1936, but the railways refused. The Minister of Public Works brought the matter before the Railway Council, which also refused to support its request, on the ground that the financial consequences were detrimental to the interests of the railways. The Minister again referred the question to the council and again met with a refusal. The council, however, agreed to consider a thorough revision of the wine tariffs in order to come to some arrangement, which would give relief to the winegrowers without imposing too heavy a financial burden on the railways. Meanwhile, M. Laurent Eynac, Minister of Public Works, has extended the reduced tariffs for a further period of six months.

HINTS FROM OVERSEAS RAILWAYS

Some extracts from the Special Overseas Number of "The Railway Gazette" which may be worth while investigating by home and other overseas administrations

A Special Overseas Number of THE RAILWAY GAZETTE *was issued on November 27, and has been sent to all annual subscribers. This Number is devoted entirely to recent progress made by, and current problems affecting, various railways in the Dominions, Colonies, and other countries such as Argentina and Brazil where British-owned railways operate. It contains a valuable fund of information regarding various problems confronting railway administrations in all parts of the world. The following extracts from articles in this special issue may serve as subjects worthy of investigation by other administrations at home and abroad who may be confronted with similar problems and difficulties.*

Policy of "Competition" and "Co-operation" Irreconcilable

Since 1933 the Canadian Pacific and the Canadian National have been co-operating in an attempt to secure joint economies under the authority of the Canadian National-Canadian Pacific Act. Limited savings have resulted, mainly from the pooling of passenger train services, but the total to date has not been great. To the end of 1934, the combined annual economy for both the Canadian National and the Canadian Pacific has been estimated as $1,093,000, a figure which is in striking contrast with some of the estimates given when the plan was being advocated. The difficulties involved in assuring an equal share of the savings and of the burden and advantages to each railway can be appreciated only by those who have attempted to conclude agreements of this nature.—*From an article entitled "Canadian Pacific Railway."*

"Pick Up and Delivery" Rates Instituted

The increasing competition from motor vehicles has been another problem calling for counter measures. In portions of the Provinces of Ontario and Quebec, where this competition is most severe, special pick-up and delivery rates have been established. These rates have proved popular with shippers and have retained for the railways much traffic that would otherwise have gone to the road.—*From an article entitled "Canadian Pacific Railway."*

Running of Excursion Trains

The running of excursion trains between Cairo and Alexandria was resumed on June 2, and up to August 18 some 75 trips were run between these points. These trains are exceedingly popular and during the period under review some 32,466 tickets were issued for them. The 75 trips mentioned above showed a net profit of £E9,681,505 mms. —*From an article entitled "Egyptian State Railways."*

Extended Parcels and Luggage Service

On August 1, 1935, the Egyptian State Railways instituted a system for the collection and delivery of all parcels traffic by express and passenger trains at Cairo and Alexandria. Parcels from all E.S.R. stations are now delivered in Cairo and Alexandria within an 8-km. radius of the main stations, when the address of the consignee is given by the senders. Personal luggage is collected and delivered from and to passengers' private addresses in Cairo and Alexandria on request, and also from or to steamers in the case of passengers arriving or departing by steamers at Alexandria.—*From an article entitled "Egyptian State Railways."*

Experiment with Long Welded Rails

Experiments are now being carried out by the Way and Works Department with long welded rail lengths. In April last 1 km. of track was laid down in 36-m. rails, each composed of two 18-metre rolled lengths electrically welded together. The standard length of rail is 12 m., and they are of the flat bottom type weighing 42 kg.—*From an article entitled "Egyptian State Railways."*

New Goods Classification and Simplified Rating Tables

In the commercial section of the Traffic Department, close attention has continued to be given to rating problems. The policy which has been pursued of creating the maximum inducement to consignors to make the best possible use of wagon capacity has contributed both to the recovery of trade and to economy of working.—*From an article entitled "Sudan Railways."*

Training of Native Staff

In the operating section of the Traffic Department good progress has been made in the training of native personnel in the safe handling of the long and heavy trains of up to 1,200 tons gross which are now common practice. It is hoped shortly to provide funds for the equipment of the Traffic Training School with model track, stations, and signalling of typical design, which should have a high educative value.—*From an article entitled "Sudan Railways."*

Standard Third Class Fare ½d. per Mile

After a period of experimental piecemeal reductions, third class fares have been reduced to one halfpenny a mile throughout the system, with specially low fares over certain stretches of the lines which are in competition with road transport. It has been proved conclusively that offering a cheap single fare is more effective than maintaining a fairly high standard single fare and offering return tickets at greatly reduced rates.—*From an article entitled "Gold Coast Railways."*

New Flat Rates and Reduced Third Class Fares

In order to bring the cost of railway transport down to the lowest practicable figure and to meet the needs of the country, a flat rate (embracing a number of previous classes) of 2d. per ton-mile has been introduced for 300 miles north of Lagos and 184 miles north of Port Harcourt. At the same time the local haulage charges within the demarcated port areas at Lagos and Port Harcourt have been combined into a low flat rate per wagon, irrespective of contents or distance hauled within the port areas.—*From an article entitled "Nigerian Government Railway."*

Other Railway Improvements

An important work was the raising of the level of the line across the Pungwe Flats in Mozambique Territory, some 36 miles inland from Beira. This was rendered necessary by the periodical interruptions to traffic caused by the flooding of the low-lying country through which the Pungwe River runs on its approach to the sea. The work involved an expenditure of £420,000 and included a new bridge over the river and a series of eight viaducts of an average length of 1,000 ft.—*From an article entitled "Beira and Mashonaland and Rhodesia Railways."*

£10,000,000 to be Spent on Railway Improvements

The prosperity of the gold mining industry has not only led to greater and prospective development of that industry, but has resulted in considerable expansion of other and subsidiary industries, the increased activities of which, as a whole, have placed a severe strain on the resources of the South African Railways and, furthermore, have necessitated the adoption of a comprehensive scheme of railway improvements. These, estimated to cost a sum of approximately £10,000,000 spread over a number of years, provide, among other things, for the strengthening of main line bridges and culverts to permit of the standard axle-load being increased to 22 tons; the re-location of the track at various points to eliminate severe grades and curvature; the replacement of 80-lb. by 96-lb. section rails on main lines (the 80-lb. released material to be utilised on branch lines where 60-lb. and lighter rails are now laid); the provision of additional running tracks, sidings and marshalling facilities; the replacement of obsolete rolling stock by modern equipment of increased capacity; and, finally, the adoption of electric traction on a further 437 miles of track, suburban as well as main line.—*From an article entitled " South African Railways."*

Airway Services now Operated by the Railways Administration

In 1934 the administration acquired as a going concern the airways service previously operated by Union Airways (Pty.) Limited, between Durban and Johannesburg (Rand Airport) and Durban and Cape Town, in addition to its single-engined aeroplanes and other equipment. Since taking over the service the administration has taken delivery of four multi-engined all-metal seventeen-seater aeroplanes, and the above services, together with a new service operating directly between the Rand Airport and Cape Town, are now operated exclusively by the multi-engined machines. The new aeroplanes, which have a cruising speed of 150 miles per hour, complete the journey in either direction between the Rand and Durban in two hours, between Durban and Cape Town in approximately six flying hours, and between the Rand and Cape Town directly in approximately six flying hours.—*From an article entitled " South African Railways."*

Light Rail Units

A highly important transport development is the board's decision to use petrol-driven railcars on the Wellington-Rimutaka-Palmerston North route for day services, and also between Wellington and New Plymouth for night running. The cars have been ordered and are of the most modern type, weighing up to 28 tons fully loaded and carrying up to 56 passengers and a ton of luggage.

The board feels that light rail units will do a great deal to meet the demand for fast, light and comfortable services at frequent intervals, and very careful calculation shows that this can be done, on the routes chosen, at a cost substantially less than the cost of steam services.—*From an article entitled "New Zealand Government Railways."*

Railcar Services Well Patronised

The railcar services, of which there are upward of sixty at present in operation throughout the State, continue to be well patronised and are enabling the department to provide residents in country districts with quick and economical services which, because of the high cost involved, could not be provided by steam operated trains. These cars are driven by petrol engines, which are giving excellent results.—*From an article entitled " Queensland Government Railways."*

Introduction of Diesel Trains

The first of 50 new corridor cars for service on long-distance trains has just been delivered. The cars contain many new features and will add to the comfort of patrons travelling in the country trains. The introduction of diesel trains is contemplated. Ten Harland and Wolff engine units, with the aid of which five trains will be built in the workshops, are being imported. These will enable exhaustive experiments to be made on country lines to test the suitability of diesel trains for service.

In order to meet the demand for greater speed and greater comfort considerable attention is being given to the rolling stock and track. The Government has made available to the administration, free of interest, a sum of £3,000,000 to be spent for that purpose during the next three years. Recent speed trials have shown that it will be possible to accelerate some trains to a timetable comparable with crack trains in other parts of the world. —*From an article entitled " New South Wales Government Railways."*

Reductions in Freight Rates

Following upon the introduction of legislation to co-ordinate transport services, and in anticipation of the relief which would be derived from the elimination of unfair competition by road vehicles, reductions in rail freights to the extent of £50,000 per annum were made from July 1, 1934, the alterations taking the shape of the abolition of the highest rate (third class) and transfer of commodities classified thereat to second class. A review of the special tariff under which consignments of up to 3 cwt. were charged was also made.

With the actual withdrawal from the field as from January 1, 1935, of competing road services, rates were again reviewed, and on March 1 further easements in freight were conceded. The cumulative effect of this review, and of the earlier reductions made, is estimated to reduce railway revenue by £105,000 per annum, but it is confidently anticipated that this amount will be recouped by the additional traffic gained as a result.—*From an article entitled "Western Australian Government Railways."*

Instruction of Permanent Way Staff by Correspondence

Throughout every railway system the need for a definite training of the staff presents itself, and to offset the increase in cost of working expenses it is necessary that the utmost efficiency in staff operations should be closely observed. In South Australia, with a scattered population of approximately 600,000 within an area of 380,000 square miles, the problem of reaching the members of the permanent way staff in outlying country districts has been overcome by the introduction of instruction by correspondence. The course covers a wide range, dealing with such subjects as earthworks, ballast, spiking, care of tools, sleepers,

rails, fastenings, rail creep, curves, accidents, grass burning, switches, crossings, check rails, time sheets, materials, wear on crossings, clearances, gauging, lining of track, fences, laying in a turnout, and lifting the track, &c.—*From an article entitled "South Australian Government Railways."*

Revision of Freight Rates

Last year there was a thorough revision of freight and livestock rates, and also in the classification of commodities, such alterations being in the main in the favour of the trader, and it is gratifying to find that this reclassification has not only conferred benefit on the general community, but has led to an increased tonnage in general merchandise traffic over the railways, with a resultant improvement in revenue.—*From an article entitled "South Australian Government Railways."*

Suggested Reduction of Railway Capitalisation

As has previously been pointed out, the South Australian Railways are saddled with the payment of interest on a large amount representing depreciated assets, and representations have been made to the Government for the capitalisation of the railways to be reduced by an amount of £10,800,000, to bring the capital down to a sum approximately commensurate with the revenue-producing value of the railways, the contention of the management being that the State as a whole has been developed by the construction of many railway lines, which have been mainly of a purely developmental nature, and that the time has now arrived for the capital to be reduced.—*From an article entitled "South Australian Government Railways."*

Accelerating Country Train Services

Since April, 1934, a State-wide overhaul of country train services has been in progress. The objectives are :—

(1) Faster schedules.

(2) More convenient services.

(3) Later departure times of late afternoon country trains from Melbourne.

(4) Earlier arrival times of country trains in Melbourne.

Vast improvements have been effected in the train services. Through the re-arrangement of the schedules the aggregate running times on country lines have been reduced by the equivalent of 260 hours a week.—*From an article entitled "Victorian Government Railways."*

Good Results from "Job Analysis"

As soon as the general fall in railway revenues consequent upon the trade depression became marked, the administration launched an energetic economy campaign in all departments. Obviously, a reduction in train miles offered the readiest means of retrenchment. But the necessity for maintaining an efficient passenger and goods service exerted a limiting influence in this direction. Nevertheless, the train mileage figure was brought down from 314,000 in 1928-29 to 281,000 in 1931-32, and has since increased but slightly. In accordance with the recommendation of the Pope Committee, a special organisation under a Deputy Agent, Organisation, was set up in 1933 for the purpose of conducting investigations on job analysis lines. As a result of these investigations, arrangements were made for the supply of coal from the collieries situated closer to the places of consumption, thus effecting considerable economy in freight. The increased use of cheaper grades of coal, wherever possible, further reduced the coal bill for the railway. Small alterations in the grates of fireboxes permitted the use of slack coal on shunting engines. It was also found that many parts of obsolete types of locomotives previously sold as scrap, could be utilised for the manufacture of other items in which raw materials were formerly used. As a result of job analysis carried out in running sheds, workshops, stations, and other departmental units, substantial reductions in staff were made. These major investigations alone produced a saving of nearly Rs. 7 lakhs (£52,500) in the year 1933-34.

In addition, the Organisation Department was responsible for the initiation of several investigations resulting in increased efficiency in operation. A substantial reduction in the goods train miles operated has been effected by the institution of heavier loads on certain sections of the railway. By a more intensive use of locomotives, it has been found possible to reduce the number of locomotives in daily use by 83 (*i.e.*, by 8·58 per cent.). A revised procedure has been introduced from February, 1934, for fixing the mileages run by locomotives between periodic overhauls. These changes have substantially reduced the working expenses of the railway.—*From an article entitled "East Indian Railway."*

"Job Analysis"

The "job analysis" organisation, which was set up as a result of Mr. Pope's visit to India, continued its work. A considerable amount of back-checking was done to ascertain the amount of savings resulting from recommendations made. Further savings are anticipated. In addition, departments themselves have effected annual savings of approximately 2 lakhs by introducing economies. It is of interest to note that the number of staff per 1,000 train miles fell from 4·56 in 1933-34 to 3·65 in 1934-35.—*From an article entitled "Great Indian Peninsula Railway."*

"Job Analysis"

The Organisation Branch, inaugurated two years ago on the recommendation of the Pope Committee, continued to work as a research unit in matters affecting working expenses in close co-operation with divisions and branches. The total saving in working expenses effected as a result of the investigation of this branch, now amounts to Rs. 25 lakhs per annum as against Rs. 9·5 lakhs reported last year. The savings effected during the year under review, therefore, amounted to Rs. 15·5 lakhs (£0·12 million) per annum.

Another important recommendation of the Pope Committee was given effect to during the year by the inauguration, as an experiment, of a Sales Branch in charge of a senior scale officer. Its chief functions, in addition to the usual publicity work, are to study the conditions which enable road transport to compete successfully with the railway with a view to making railway transport equally attractive and ensuring that the public gets the service that satisfies it, and to inculcate the spirit of salesmanship and service into the staff by example and instruction.—*From an article entitled "North Western (State) Railway, India."*

"Job Analysis"

Job analysis resulting from the Pope Committee's reports and the appointment, until December last, of a Special Organisation Officer, will it is estimated, effect a permanent all-round saving of Rs. 1,37,000 per annum upon the Burma Railways, once full effect has been given to all the measures recommended and accepted by the administration.—*From an article entitled "Burma Railways."*

Intensive User of Locomotives

The intensive use of locomotives has been in force on the Bhusaval Division for over 2 years. The machine shop and locomotive shed at Bhusaval were extended and modernised, as a higher standard of maintenance of engines was required. For a passenger engine a typical run is: Bhusaval-Igatpuri-Itarsi-Nagpur-Bhusaval, a distance of 999 miles. Changes of crew are made at Igatpuri, Bhusaval, Itarsi and Nagpur, for mail trains, and on passenger trains an additional change is made at Badnera, between Bhusaval and Nagpur. In a similar manner, goods engine runs have been extended, a typical run being Bhusaval-Itarsi-Bhusaval, a distance of 374 miles. This trip is worked by three crews on through trains, and on work trains by six crews.—*From an article entitled "Great Indian Peninsula Railway."*

Regaining Passengers from Roads

In common with all railways in the country, the South Indian Railway Company is affected adversely by motor-bus competition. Reduced fares have been quoted and convenient train services have been introduced to compete with these road services. There is also considerable competition from goods transport by road. One of the methods adopted to meet this competition is the provision of containers, but so far Indian merchants have been slow to appreciate these.—*From an article entitled "South Indian Railway."*

Road Co-operation Improves Goods Services

Efforts are made to combat lorry competition by co-ordinated services for the delivery of goods traffic, working in conjunction with well established road haulage firms, and by the introduction in Colombo and Kandy of a collection and delivery service for parcels and light van goods worked by lorries owned by the railway. Special concession rates have been given for goods tendered in large lots, particularly for rice and curry stuffs which form the staple food of the indigenous population.

Return tickets, which were abolished on the reduction of the single fares in 1931 with a view to stopping misuse of the return halves, have been restored at the old rates owing to strong pressure brought upon the authorities, but the availability of the return portion has been reduced from 30 days to 10, thus giving less scope for the use of a return ticket more than once.—*From an article entitled "Ceylon Government Railway."*

Training of Staff

An up-to-date and adequate organisation has been provided for the recruiting and training of youths for all locally appointed grades in the service. For the higher subordinate technical posts, youths having general education of matriculation standard are selected for a 4-year course of training, about 2 years of which is spent in a technical school. For meeting the railway's needs of artisans of all kinds, a large number of apprentices are constantly under training. These youths, most of whom are English-speaking, receive a 5-year course of training in the Central Workshops, supplemented by evening classes in machine drawing, workshop mechanics, and similar subjects. Apprentices for training as guards, signalmen, and station and yard staff undergo a 3-year course of training, the time being divided between courses of instruction in the Transportation School and in gaining experience at stations. The railways do not now employ European drivers. Locally recruited youths of sound physique are given a 5-year course of training in the running sheds, on the engine footplate on line, and also in the Transportation School.—*From an article entitled "Federated Malay States Railways."*

More Vacuum Fitted Goods Wagons

As regards other noteworthy improvements and developments in the past year, the fitting of goods vehicles with vacuum brake equipment has been proceeded with, and at the present time the company has approximately 700 vehicles so fitted. The major portion of these are concentrated in the Itapemirim-Victoria section, mentioned above, and have an additional vacuum reservoir to allow greater safety in running down the steepest gradients. In addition to closed vehicles for coffee traffic, several open wagons have received this equipment.—*From an article entitled "Leopoldina Railway."*

Economic use of Restaurant Cars

Due to increased road competition and the prevailing economic depression, the heavy twin dining car sets in use on long distance main line trains were not utilised by passengers to anything like their full capacity, and in order, therefore, to reduce running costs and make the seating capacity compatible with present day requirements, the conversion of four of these sets to self-contained units was undertaken in the carriage and wagon workshops. These coaches were completely rebuilt, with kitchen, sleeping quarters for the staff, and table accommodation for 24 passengers. The interior finish is hand polished mahogany and the tip-up seats were upholstered in green Rexine. —*From an article entitled "Cordoba Central Railway."*

Surplus Stock Exchanged for Railcars

For certain through services the State Railways are providing railcars in exchange for the use of surplus locomotive and goods rolling stock. These State Railways vehicles are single-car units constructed by the Brill Company of the U.S.A. They are equipped with a 160-h.p. petrol engine, and have accommodation for 60 passengers (first class), with a maximum speed of 68 m.p.h. On a trial trip over the Central Uruguay Eastern Extension line, the outward journey between Montevideo and Treinta y Tres (213·2 miles) was accomplished in 5 hr. 15 min., and the return journey in 5 hr. 5 min., as compared with the present timings of 8 hr. 45 min. with steam trains. The average running speed, including stops, was 40·3 m.p.h., and the maximum attained was 63·9 m.p.h. between Sauce and Santa Rosa on the outward journey, and between Trienta y Tres and Corrales on the return. The type proposed for the company's own railcars is an articulated diesel-electric unit to carry 72 first class and 52 second class passengers, and to be equipped with a buffet. The vehicles will be powered by a 220-h.p. diesel engine at each end. —*From an article entitled "Central Argentine Railway."*

Growing Excursion Traffic—Popularity of Train Cruises

During the year 64 excursion trains were run at specially reduced rates. The policy of fostering excursions has met with great success—a total of 25,520 passengers was carried in this way, representing a return of £52,100.

Great popularity has also attended the *de luxe* cruising train, *El Crucero*, which for the third time has effected a nine-day run over the company's system, stopping for a short time at the most picturesque spots, where the passengers were taken on excursions in the surrounding districts.—*From an article entitled "Buenos Ayres and Pacific Railway."*

MODERN DEVELOPMENTS IN THE HEAT TREATMENT OF STEEL RAILS

An article describing the latest plant for applying the Sandberg Regulated Sorbitic treatment to rails, and giving details of test results, especially the high yield points, and the exceptional toughness and uniformity of physical properties obtained after treatment of steels of varying analyses, as evidence of the exact control afforded by the appliances now in use

By CECIL J. ALLEN, M.Inst.T.

SINCE the first introduction of the Sandberg process for heat-treating the heads of railway and tramway rails, with the object of producing in the head the sorbitic structure, a greater tonnage has been treated by this method than by any other heat treatment; the aggregate is now approximately 200,000 tons. During these years considerable advances have been made, both in the application of the treatment, and in the results obtained. A structure of pure sorbite is now obtained consistently in the upper part of the rail-head; the physical tests obtained on steels of different analyses, which have been subjected to the treatment, show a striking consistency of result, which in itself witnesses to the exactness of the present methods of controlling the treatment; the introduction of retarded cooling of the rails in the Sandberg oven, which now follows the head treatment, is an adequate protection against the possibility of transverse fissuring in the rail-head as a result of the treatment; and perhaps the fullest proof of the efficiency of the treatment, from the rail wear point of view, is given in the high yield stresses now obtained, which at a depth of $\frac{1}{8}$-in. under the rail-head are frequently as high as 58 to 66 tons per sq. in.

The most material improvement in the process has been brought about by considerably increasing the pressure of the water which is used for the spraying of the head of the heated rail in the first stage of the quench, as compared with the uniform pressure previously used. To mark this alteration of method, the name of the process was changed to the Sandberg Regulated Sorbitic treatment, which forms the subject of the present article. The rolling mills of four British railmaking firms are now equipped for its application. They are the Cargo Fleet Iron Co. Ltd., of Middlesbrough; Dorman, Long & Co. Ltd., at Cleveland works, Middlesbrough; the Lancashire Steel Corporation Limited, at Irlam works, near Manchester; and the United Steel Companies Limited, at Workington, Cumberland, whose total output of regulated sorbitic rails has now exceeded 20,000 tons. The Cargo Fleet Iron Company and the Lancashire Steel Corporation can treat rails up to 90 ft. in length, whereas the plants at the other two works are limited at present to handling 60 ft. rails; all four plants are adequate for handling the entire mill output.

The most recent of the plants is that which has been installed at the Cleveland works of Dorman, Long & Co. Ltd., and which forms the subject of certain of the illustrations. The treatment apparatus is carried on girders which span the width of the rail bank, and which by suitable electrical gear can be lowered and raised as required, so differing from the earlier plant at this works, in which the rails were lifted up to the jets for treatment. From the hot-saw the rails, immediately after rolling, are collected by specially designed skids in the space between the mill roller-train and the treatment plant, as the temperature at which treatment is begun is of great importance. At the hot-saw the residual temperature from the rolling is normally about 900 deg. C.; the temperature at which treatment is begun is from 850 deg. down to 780 deg., and this is automatically checked by pyrometers located in a suitable position on the hot-bank for this purpose.

The Method of Treatment

The actual treatment consists in the application to the rail-head of a finely atomised spray of water, in the form of a Scotch mist. When the rails have cooled to the right temperature for treatment, as visually indicated by the pyrometers to the operator, they are skidded two at a time to the apparatus, turned head upwards, and centred by the skids under the jets. The treatment plant is then lowered by electrical power until the distance between the jets and the rail-heads is reduced to $3\frac{1}{2}$ in. The jets are spaced at even intervals of $2\frac{1}{2}$ in. from one end of each rail to the other, and the atomised spray spreads out fanwise from each jet in such a way that the quenching effect is evenly applied to the whole length and width of the rail-head. Air from electrically-driven fans at a pressure of 0·9 lb. per sq. in. is used for the atomisation, and there are five air passages per jet, into each of which water is led through holes at right-angles to the direction of the air, so ensuring even atomisation at all pressures through each jet. For the first part of the quench the water is fed to the centre main at a pressure corresponding to a head of 23 ft.; during the remainder of the quench the head is reduced to 2 ft. For most rail sections, the treatment is applied with the 23 ft. head for 15 sec., followed by 20 sec. at 2 ft. head. In the apparatus at the Cleveland works, the change of head in the middle of the quench is effected by an electric solenoid, automatically operated on a time basis, which works a butterfly valve in the water duct. The duration of treatment remains constant for any given rail section, but variations in the carbon contents of the different casts of steel are compensated for by variations of the starting temperature within the limits mentioned above, with the object of obtaining as consistent a result as possible. This consistency is well illustrated in the test results which follow. The operator at the plant has, therefore, to concern himself only with the commencing temperature of the rails, with turning on the spray, and with skidding the rails to and from the apparatus. Changes in the commencing temperature need to be made, of course, only as the rails change from one cast to the next, and in the case of basic open-hearth casts, which may total 60 tons of rails and upwards, such changes are relatively infrequent.

Counter-Cambering and Cooling Out

While the actual quenching is taking place, the rail-head is being cooled more rapidly than the web and foot, and the rail, if not held rigidly in position under the jets, would draw itself into a curve with the head concave and the foot convex. Immediately the rail is released from the grips after quenching, however, the web and foot cool more rapidly, and a curvature in the opposite direction, with the head convex and the foot concave,

commences. To counteract this curvature—which, if not dealt with, would occasion an excessive amount of cold-straightening—a counter-camber is now put into each treated rail. At the Cleveland works this is done with the help of a cambering machine, which consists of two swinging arms, pivoted at the sides of the hot-bank, and almost meeting in the centre when swung into line. Each of the arms, which are electrically-operated, is fitted with four rollers, so applying pressure to each rail (which is held at each end by stops), at eight different points. In this way the rail is smoothly cambered in the opposite direction; the amount of counter-camber necessary to ensure that the rail, by contraction, shall draw itself into a straight condition as it cools out, is arrived at by experience of each section.

The body of the rail is now at a temperature of about 550 deg. C., and at this heat it is passed into the Sandberg oven, for the retarded cooling which is an essential feature of the process. The treated rails remain in the oven for the usual period of about 30 min., during which the temperature throughout each rail, from head to foot, is evened out to reduce internal stresses and as a safeguard against the possibility of internal fissuring. After the temperature has thus been brought down to 300° or so, the treated rails are passed out on to the end of the hot-bank for final cooling, after which the usual operations of straightening, ending, and drilling are carried out. Each treated rail is regarded as a unit, with its own reference letter, and the composition, physical characteristics, and treatment history of each sorbitised rail are thus fully recorded.

Consistency of Result

Reference has already been made to the consistency of result which can now be relied on in applying the regulated sorbitic treatment, and this is well shown in the series of tests detailed in Table A. These represent three batches of rails tested under the supervision of the writer at the Workington works of the United Steel Companies, of the 100 lb., 95 lb., and 85 lb. R.B.S. bull-head sections respectively. The table gives the analysis and tensile tests in respect of 17 different casts; and emphasis may be laid on the fact that all the casts were, in the usual way, selected at random for test purposes, and the results are here shown without any omissions, except the details relative to a number of casts on which falling weight and impression tests only were made, so giving a complete survey of these three rollings.

It will be noted that, whereas the tensile tests on the untreated rails show ultimate breaking strengths of from 48·8 to 54·0 tons per sq. in., the sorbitic treatment not merely raised the strength by tonnages varying from 7·8 to 13·8, but also levelled up the physical properties of the original steels to a common standard of striking uniformity, as with one exception (65·6 tons per sq. in.), the whole of the ultimate breaking strengths of the treated rails lay between the limits of 60·0 and 64·2 tons per sq. in. As regards elongation, none of the tests on the treated rails showed less than 13 per cent. on a gauge length of 2 in., even with so high a stress as 65·6 tons per sq. in., and with an average rise of 11·2 tons per sq. in. in tensile tonnage as a result of treatment, the average reduction in elongation was no more than from 4 per cent.—from 18·9 to 14·8 per cent.—while the percentage reduction of area remained practically unaltered. But while the average breaking strength of the steel rose by 22 per cent., the average yield point rose by 17·1 tons, from 27·6 to 44·7 tons per sq. in., which works out at 62 per cent. increase. That is to say, whereas in the untreated steel the yield averaged 54 per cent. of the ultimate strength, in the treated rail-heads the average yield had increased to 71 per cent. of the ultimate strength. All these tensile tests were on test-pieces of the B.S. standard type, of 0·564 in. dia., cut from a position at the side of the rail-

TABLE A.—ANALYSES AND TENSILE TESTS ON THREE ROLLINGS OF SANDBERG REGULATED SORBITIC BULL-HEAD RAILS SHOWING UNIFORMITY OF RESULT OBTAINED

Makers: The United Steel Companies Limited, Workington, Cumberland.

Tensile tests on B.S.I. standard test-piece, 0·564 in. dia., elongation measured on 2-in. gauge length; centre, $\frac{7}{16}$ in. below rail-head

Rail Section	Cast No.	Analysis					Untreated		Treated		Elongation		Contraction	
		C	Si	S	P	Mn	Yield Point	Ultimate Stress	Yield Point	Ultimate Stress	Untreated	Treated	Untreated	Treated
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Tons per sq. in.	Tons per sq. in.	Tons per sq. in.	Tons per sq. in.	Per cent.	Per cent.	Per cent.	Per cent.
100 lb. ..	41	0·49	0·109	0·049	0·037	1·06	26·0	48·8	45·6	61·2	17·5	14·5	27·6	27·6
.. ..	43	0·49	0·125	0·045	0·038	1·06	28·2	49·8	44·8	62·4	19·0	14·5	29·2	27·6
.. ..	44	0·50	0·106	0·040	0·036	1·08	27·6	49·2	45·2	62·4	18·0	14·5	27·6	27·6
.. ..	45	0·50	0·115	0·041	0·039	1·11	29·6	50·8	42·4	62·8	17·0	14·0	26·4	27·6
.. ..	46	0·50	0·100	0·040	0·037	1·14	30·0	52·0	48·4	64·2	15·5	13·5	23·2	23·2
.. ..	48	0·51	0·106	0·041	0·036	1·10	28·0	50·4	43·2	62·4	18·0	13·5	26·4	24·8
	Average						28·2	50·2	44·9	62·6	17·5	14·1	26·8	26·4
95 lb. ..	8	0·50	0·131	0·042	0·043	1·22	25·2	53·0	41·2	65·6	20·0	13·0	35·2	27·6
.. ..	14	0·50	0·106	0·049	0·039	1·18	27·2	52·0	44·0	63·2	20·0	13·5	33·6	29·2
.. ..	20	0·48	0·106	0·046	0·042	1·14	25·6	50·4	44·0	62·8	20·0	16·5	33·6	30·8
.. ..	28	0·50	0·115	0·046	0·040	1·21	25·2	51·2	47·6	61·6	20·0	14·5	33·6	32·4
	Average						25·8	51·7	44·2	63·3	20·0	14·4	34·0	30·0
85 lb. ..	5	0·48	0·128	0·036	0·037	1·03	26·8	50·4	45·6	64·2	21·0	16·0	40·8	32·4
.. ..	6	0·49	0·122	0·043	0·039	1·13	28·8	52·4	45·2	61·6	19·5	15·5	35·2	29·2
.. ..	7	0·50	0·122	0·036	0·039	1·06	28·8	52·4	44·8	60·6	18·5	16·5	29·2	35·2
.. ..	8	0·49	0·137	0·039	0·038	1·15	28·8	52·0	44·4	62·0	19·0	15·5	30·8	35·2
.. ..	9	0·48	0·137	0·038	0·037	1·08	28·8	50·4	40·4	60·0	20·0	17·5	33·6	36·4
.. ..	10	0·49	0·144	0·041	0·039	1·12	30·4	53·6	44·8	61·4	18·0	14·5	29·2	24·8
.. ..	11	0·49	0·144	0·040	0·038	1·12	29·6	54·0	48·8	64·0	18·0	16·0	29·2	27·6
	Average						28·9	52·2	44·9	62·0	19·2	15·9	32·6	31·5

head in which the centre-line of the test is 11 mm. or $\frac{3}{8}$ in. below the running surface of the rail. The steel was of Bessemer acid quality.

Tests for Toughness and Hardness

Tables B, C, and D give details of a selection of tests made at all the four British works which are equipped for the application of the regulated sorbitic treatment, on both bull-head and flat-bottom rails. Table B shows the makers, the steel process, and the analysis of each cast; Table C the falling weight and tensile tests; and Table D the impression and Brinell tests. It will be seen that the analyses comprise rails of both the B.S. high carbon composition, and also the medium manganese analysis now standard on British railways; there is one cast (F) which in addition contained 0·47 per cent. of chromium. All the falling weight tests were imposed in accordance with the B.S. standard tests laid down for the rail section concerned, and were sustained without fracture, and in every instance additional blows were sustained without fracture. The majority of the test pieces, as distinguished by the letter "R," were reversed on the supports for the third blow, which they thus received on the foot instead of on the head.

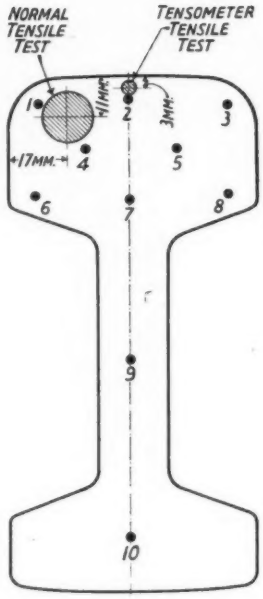


Fig. 1

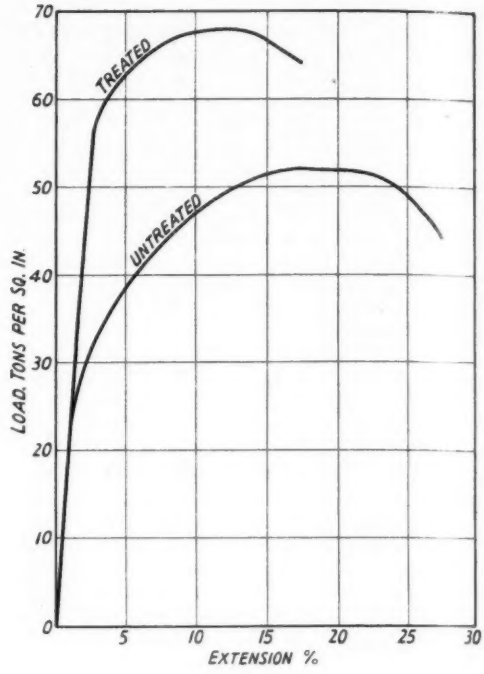


Fig. 2

The tensile tests have the characteristics already emphasised, including high yield points, which in the case of Casts B, E, F, L and M, attained to or exceeded 50 tons per sq. in. In Cast B the breaking strength of the steel was raised by treatment from 49·2 to 68·4 tons per sq. in.; and certain remarkable percentages of extension will be noted, such as 18 per cent. with 64·4 tons per sq. in. (Cast F, which contained 0·47 per cent. chromium), 15·5 per cent. with 63·8 tons per sq. in. (Casts N and P), 13·5 per cent. with 68·4 tons per sq. in. (Cast C). In the case of Cast F (containing chromium), the percentage reduction of area was actually increased from 33·6 to 50·0 per cent. after treatment; and in Casts N, O, and P there were also considerably more marked reductions of area; elsewhere the reductions were equal or slightly smaller after treatment. The same consistency in these results as in those of Table A cannot be expected as the varying requirements of different users were being worked to.

Table D shows first the results of the impression tests,

TABLE B.—A SELECTION OF VARIOUS SANDBERG REGULATED SORBITIC RAILS—ANALYSES

Reference Letter	Manufacturer	Steel Process	Rail Section	Cast No.	Analysis					Notes
					Carbon	Silicon	Sulphur	Phos-phorus	Manga-nese	
					Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
A ..	Dorman, Long & Co. Ltd. ..	O.B.	85-lb. B.H.	244	0·50	0·130	0·035	0·030	1·00	M.M.
B ..	,, ,, ..	,,	,,	249	0·54	0·120	0·034	0·030	1·00	M.M.
C ..	,, ,, ..	,,	96-lb. F.B.	8	0·60	0·120	0·032	0·023	0·79	H.C.
D ..	Cargo Fleet Iron Co. Ltd. ..	O.B.	95-lb. B.H.	1329	0·54	0·105	0·028	0·039	0·99	M.M.
E ..	,, ,, ..	,,	,,	1921	0·56	0·103	0·033	0·038	0·97	M.M.
F ..	,, ,, ..	,,	,,	1920	*0·49	0·121	0·031	0·033	0·98	M.M.
G ..	,, ,, ..	,,	96-lb. F.B.	54	0·58	0·113	0·028	0·038	0·78	H.C.
H ..	United Steel Co. Ltd. ..	B.A.	95-lb. B.H.	8	0·50	0·131	0·042	0·043	1·22	M.M.
J ..	,, ,, ..	,,	,,	14	0·50	0·106	0·049	0·039	1·18	M.M.
K ..	,, ,, ..	,,	,,	28	0·50	0·115	0·046	0·040	1·21	M.M.
L ..	,, ,, ..	,,	95-lb. F.B.	79	0·53	0·125	0·040	0·044	0·91	—
M ..	,, ,, ..	,,	,,	80	0·52	0·119	0·039	0·047	0·90	—
N ..	Lancashire Steel Corporation	O.B.	95-lb. B.H.	7578	0·53	0·159	0·027	0·030	0·98	M.M.
O ..	,, ,, ..	,,	,,	7590	0·56	0·154	0·028	0·031	1·02	M.M.
P ..	,, ,, ..	,,	,,	7591	0·53	0·107	0·029	0·033	1·03	M.M.

O.B.—Open-hearth basic. B.A.—Bessemer acid. B.H.—Bull-head. F.B.—Flat-bottomed. M.M.—Medium manganese analysis. H.C.—Higher carbon analysis.
* This cast contained also 0·47 per cent. chromium.

TABLE C.—A SELECTION OF VARIOUS SANDBERG REGULATED SORBITIC RAILS—FALLING WEIGHT AND TENSILE TESTS

Cast Reference Letter	Quality	Height of Fall, 1-ton Tup	Falling Weight Test Deflections			Tensile Tests				Increase in by Treatment	
			1st Blow	2nd Blow	3rd Blow	Yield Stress	Ultimate Stress	Elongation in 2 in.	Reduction of Area	Yield Stress	Ultimate Stress
			In.	In.	In.	Tons per sq. in.	Tons per sq. in.	Per cent.	Per cent.	Per cent.	Per cent.
A	Untreated ..	X	1·15	3·55	—	26·4	49·6	19·5	36·4		
,,	Treated ..	,,	0·90	3·05	Stood ..	40·0	63·2	16·0	33·6	51	27
B	Untreated ..	,,	1·05	3·40	—	26·0	49·2	19·0	30·8		
,,	Treated ..	,,	0·90	2·95	Stood R	50·0	68·4	13·0	24·8	92	39
C	Untreated ..	Y	2·95	—	—	26·8	51·6	16·0	24·8		
,,	Treated ..	,,	2·45	0·65 R	2·95 R	48·8	68·4	13·5	24·8	81	33
D	Untreated ..	Z	0·90	3·20	—	28·0	51·6	16·0	27·6		
,,	Treated ..	,,	0·75	2·90	Stood R	46·0	62·4	14·0	21·6	57	21
E	Untreated ..	,,	0·85	3·10	—	28·0	50·0	16·0	27·6		
,,	Treated ..	,,	0·70	2·75	Stood R	50·0	66·0	15·0	24·4	79	32
F*	Untreated ..	,,	0·85	3·00	—	30·0	52·8	17·0	33·6		
,,	Treated ..	,,	0·70	2·70	Stood R	50·4	64·4	18·0	50·0	68	22
G	Untreated ..	Y	2·80	—	—	26·4	50·4	17·0	24·4		
,,	Treated ..	,,	2·25	Stood	Stood ..	48·0	66·4	13·0	24·4	82	32
H	Untreated ..	Z	1·00	3·45	—	25·2	53·0	20·0	35·2		
,,	Treated ..	,,	0·85	2·80	4·40	41·2	65·6	13·0	27·6	63	24
J	Untreated ..	,,	1·00	3·50	—	27·2	52·0	20·0	33·6		
,,	Treated ..	,,	0·85	2·90	4·60	44·0	63·2	13·5	29·2	62	22
K	Untreated ..	,,	1·10	3·60	—	25·2	51·2	20·0	33·8		
,,	Treated ..	,,	0·85	2·90	4·70	47·6	61·6	14·5	32·4	89	20
L	Untreated ..	Y	2·90	—	—	28·8	51·2	18·0	30·8		
,,	Treated ..	,,	2·50	Stood R	Stood R	52·0	67·6	10·5	20·0	81	32
M	Untreated ..	,,	2·95	—	—	27·2	50·8	18·0	29·2		
,,	Treated ..	,,	2·55	Stood R	Stood R	50·4	66·0	10·5	18·4	85	30
N	Untreated ..	Z	0·90	3·30	—	32·0	51·4	19·0	30·6		
,,	Treated ..	,,	0·75	2·85	4·95	45·5	63·8	15·5	38·4	42	24
O	Untreated ..	,,	0·90	3·15	—	30·0	55·0	16·0	27·6		
,,	Treated ..	,,	0·75	2·80	4·90	47·6	64·7	14·5	31·8	59	18
P	Untreated ..	,,	0·90	3·25	—	29·8	50·0	17·5	27·6		
,,	Treated ..	,,	0·80	2·90	5·10	48·5	63·8	15·5	37·8	63	28

X—1st, 6 ft.; 2nd, 15 ft.; 3rd, 15 ft. Y—1st, 25 ft.; 2nd, 25 ft.; 3rd, 25 ft. Z—1st, 7 ft.; 2nd, 20 ft.; 3rd, 20 ft.
R—Rail reversed on supports, foot uppermost. * Cast containing 0·47 per cent. chromium.

TABLE D—A SELECTION OF VARIOUS SANDBERG REGULATED SORBITIC RAILS—IMPRESSION AND BRINELL TESTS

Cast Reference Letter	Quality	Impression Test, Depth of Impression	Brinell Hardness Numbers From following positions in rail section (Fig. 1)									
			1	2	3	4	5	6	7	8	9	10
		Mm.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
A	Untreated ..	3·85	207	212	207	212	217	212	207	207	201	223
,,	Treated ..	2·60	277	269	269	277	262	262	262	235	229	229
B	Untreated ..	3·80	229	235	235	235	235	229	235	235	229	235
,,	Treated ..	2·30	341	331	341	321	311	285	285	285	229	241
C	Untreated ..	3·70	235	229	229	229	229	229	229	223	223	235
,,	Treated ..	2·45	302	302	302	302	302	285	293	285	229	235
D	Untreated ..	3·50	223	223	223	223	223	217	217	212	212	229
,,	Treated ..	2·50	277	277	277	277	285	269	277	277	217	229
E	Untreated ..	3·55	223	223	223	223	223	223	223	223	212	235
,,	Treated ..	2·55	302	293	302	302	302	285	302	285	235	223
F	Untreated ..	3·30	235	235	235	235	235	229	235	229	223	248
,,	Treated ..	2·40	321	321	311	277	269	293	285	293	255	235
G	Untreated ..	3·55	217	217	223	217	223	212	223	217	229	229
,,	Treated ..	2·30	311	311	311	311	302	285	293	269	229	223
H	Untreated ..	3·40	229	229	229	223	223	229	235	229	229	241
,,	Treated ..	2·00	341	341	341	301	293	277	277	277	241	241
J	Untreated ..	3·50	217	217	217	217	217	217	235	217	229	235
,,	Treated ..	2·20	321	331	321	285	285	255	269	255	229	235
K	Untreated ..	3·50	217	217	217	217	217	217	229	217	229	229
,,	Treated ..	2·20	331	321	331	285	285	255	269	255	229	229
L	Untreated ..	3·40	207	207	207	207	207	207	229	207	229	223
,,	Treated ..	2·10	321	321	321	285	302	255	277	277	207	217
M	Untreated ..	3·40	207	207	207	207	217	207	207	207	217	223
,,	Treated ..	2·20	321	321	311	269	293	241	269	269	217	229
N	Untreated ..	3·80	228	228	228	217	235	228	248	228	241	241
,,	Treated ..	2·75	307	297	285	281	281	266	273	262	255	248
O	Untreated ..	3·75	241	241	228	241	235	223	255	223	255	255
,,	Treated ..	2·70	321	311	302	293	290	277	269	269	255	258
P	Untreated ..	3·85	228	228	228	223	235	223	241	228	235	228
,,	Treated ..	2·75	285	311	311	281	307	269	269	269	252	248

which were made, as usual, by impressing into the rail-head a hardened steel ball of 19 mm. dia. under a load of 50 tons, and measuring the depth of the impression in millimetres. Certain of the impression depths (*e.g.* Cast G) were all but halved in this way after treatment; the general average of the tests shows a reduction of about one-third in depth of impression. This test is also used from time to time in order to demonstrate the uniformity of treatment, along the entire length of a rail, by means of closely spaced impressions from one end to the other. The uniformity is also checked by microscopical and other tests. The remainder of Table D is occupied with Brinell tests which have been made in standard positions over the polished faces of prepared sections of both treated and untreated rails, with the object of demonstrating the depth of penetration of the treatment, the fact that the web and the foot are entirely unaffected, and also the gradual transition from the sorbitic structure of the rail-head down to the normal pearlitic structure of the remainder of the rail.

Brinell numbers up to and exceeding 300 can now be relied on in the outer sorbitic case of the rail-head; the middle zone of the rail-head has in most instances a Brinell number only slightly below this; and the effect of the treatment, though in a reduced degree, is still seen in the Brinell readings on the lower part of the head. The deduction of importance from these Brinell readings, however, is that the full effect of the sorbitic treatment may be relied on to the total depth—say $\frac{3}{8}$ in.—to which the rail will normally be allowed to wear down before replacement will become necessary by reason of reduced section.

Exceptional Yield Stresses

A new and important line of investigation has now been developed by the use of the Tensometer, which enables tests to be made on small scale tensile test pieces with a cross-sectional area of 1/50 sq. in., cut from the rail-head in such a position that their centres are at a depth of only 3 mm. or $\frac{1}{8}$ in. below the running surface. The use of the Tensometer also enables a graphic representation to be obtained of extension as plotted against tonnage, thus affording some striking comparisons when the Tensometer curve of the untreated steel is plotted on the same diagram as that of the treated steel, in particular, the degree in which the yield point is raised by treatment. A pair of these curves is reproduced on page 58. A few Tensometer test results on rails which have already figured in Tables B, C, and D are set out in Table E, which shows breaking strengths up to 74, 75 and 77 tons per sq. in., coupled with yield points as high as 65, 66, and 66 tons per sq. in. respectively, and this in two instances with percentages of extension between 12 and 13 per cent.

Crossed Prism Tests

Another new and effective form of comparative test has recently been brought into use, affording a direct physical comparison between treated and untreated rails. It is based on the method devised in 1722 by Réaumur, who proposed that the relative hardness of two specimens should be measured by shaping them into prisms, bringing the edges of the prisms into contact at right-angles with one another, and imposing pressure, with the object that the harder specimen should indent the softer. Réaumur afterwards abandoned this system in favour of scratch testing, and it does not appear to have been reintroduced until two centuries later, when it was once again brought into use by Dr. Haigh, of the Royal Naval College, Greenwich. In "The Hardness of Metals and its Measurement," by Hugh O'Neill, D.Sc., the author remarks that "the principle satisfies requirements of similarity, and so any linear dimensions may be used for calculating consistent and comparable Brinell hardness numbers. The appropriate effects due to piling up and sinking in are very much in evidence in the specimens, and serve to indicate their work-hardening capacity."

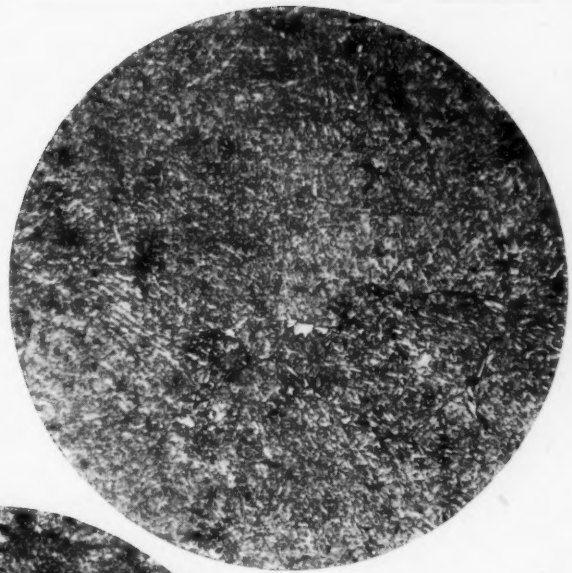
In applying this test to rail specimens, Messrs. Sandberg have the rail-head machined, in a longitudinal direction, in such a way as to leave in the centre of the test length a prism of steel, of which the apex, machined to an angle of 60 degrees, reaches to what was the running surface of the rail. The apex of a specimen which has been sorbitically treated is then arranged in a testing machine in contact with, but at right-angles to, the apex of an untreated specimen, and a pressure of 20 tons is applied. The result is to make the treated prism bite deeply into the untreated prism, and the results so obtained have been most striking, as one of the illustrations reveals. To take one typical case among the casts of which the tests are detailed in this article, the indentation of the untreated prism reached a depth of $\frac{3}{8}$ in., and a width at the top of $\frac{9}{16}$ in., whereas the depth of indentation of the treated prism was less than $\frac{1}{32}$ in.

It may reasonably be deduced from such tests as these, and from the very considerable increases in yield points that are now being consistently obtained, that the regulated development of the Sandberg sorbitic rail treatment is providing the rails so treated with the capacity for work-hardening under traffic, which, it is generally agreed by metallurgists, is the quality necessary if there is to be any material increase in the life of rails, and which was largely the secret of the phenomenal wear capacity displayed by some of the rails rolled in the earlier decades of steelmaking. As this treatment adds only from $22\frac{1}{2}$ per cent. down to as little as 15 per cent., according to the tonnage treated, to the cost of the rails at the mill to the

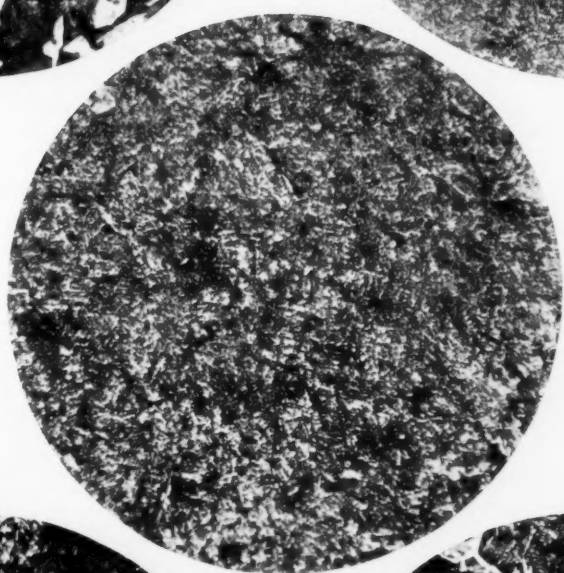
TABLE E.—SANDBERG REGULATED SORBITIC RAILS—TENSOMETER TEST RESULTS

Cast Reference Letter	Quality	Standard Tensile Tests					Tensometer Tensile Tests				
		Yield Point	Ultimate Stress	Yield / Ultimate	Elongation	Contraction of Area	Yield Point	Ultimate Stress	Yield / Ultimate	Elongation	Contraction of Area
		Tons per sq. in.	Tons per sq. in.	Per cent.	Per cent.	Per cent.	Tons per sq. in.	Tons per sq. in.	Per cent.	Per cent.	Per cent.
H	Untreated ..	25·1	53·0	48	20·0	35·2	—	—	—	—	—
,,	Treated ..	41·2	65·6	63	13·0	27·6	66	77	86	13	23
J	Untreated ..	27·2	52·0	52	20·0	33·6	—	—	—	—	—
,,	Treated ..	44·0	63·2	70	13·5	29·2	65	74	88	13	31
L	Untreated ..	28·8	51·2	56	18·0	30·8	26	50	52	24	40
,,	Treated ..	52·0	67·6	77	10·5	20·0	64	74	86	14	33
M	Untreated ..	27·2	50·8	54	18·0	20·2	25	49	51	25	40
,,	Treated ..	50·4	66·0	76	11·0	20·4	58	72	81	14	35

Above: Untreated rail $\frac{1}{8}$ in. below running surface

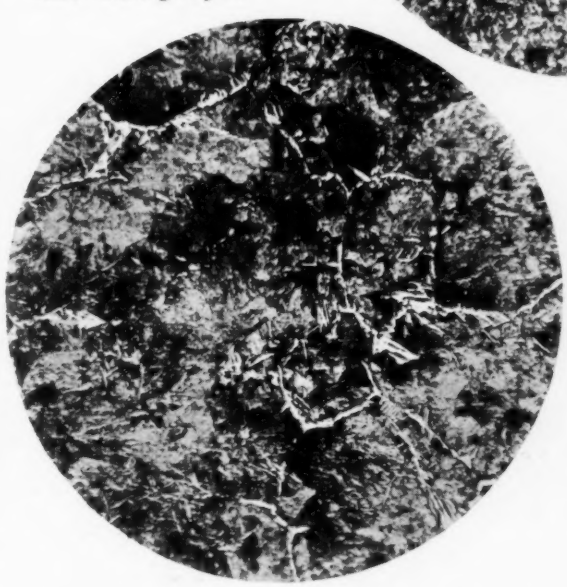


Above: Treated rail $\frac{1}{8}$ in. below running surface



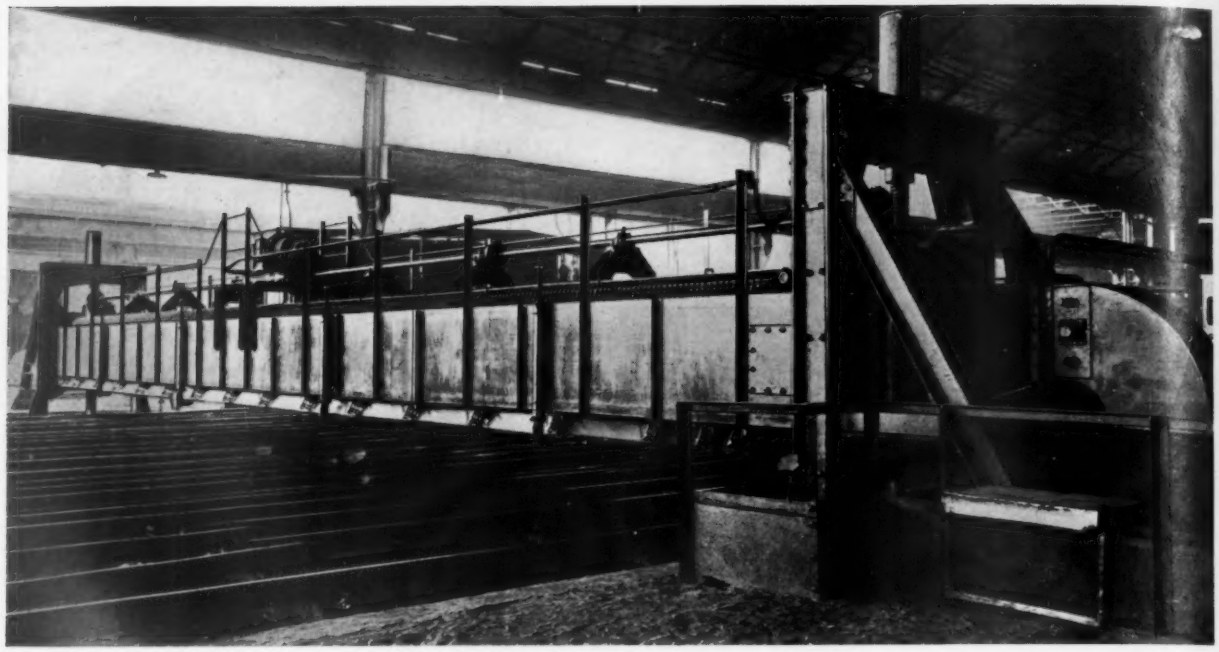
Left: Treated rail $\frac{1}{2}$ in. below running surface

Below: Treated rail $\frac{13}{16}$ in. below running surface



Below: Treated rail $1\frac{3}{16}$ in. below running surface

MICROPHOTOGRAPHS (× 250 DIA.) OF SORBITICALLY-TREATED 95-LB. B.S. BULL-HEAD RAIL

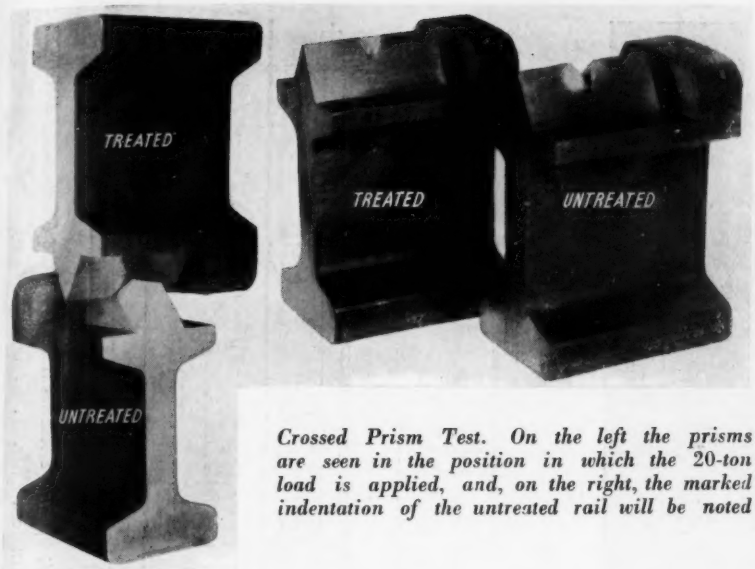


Girder carrying treatment jets across rail hot-bank. The entire plant is lowered on to the rails when treatment is in progress

Sorbitic treatment controls. The duration of the treatment is indicated in seconds on the dial seen behind the operator's head

Rail cambering plant. The right-hand rail is in the cambered condition assumed after treatment, and a counter-camber is being applied to the left-hand rail

REGULATED SORBITIC TREATMENT PLANT FOR RAILS AT THE CLEVELAND STEELWORKS, DORMAN, LONG & CO. LTD.

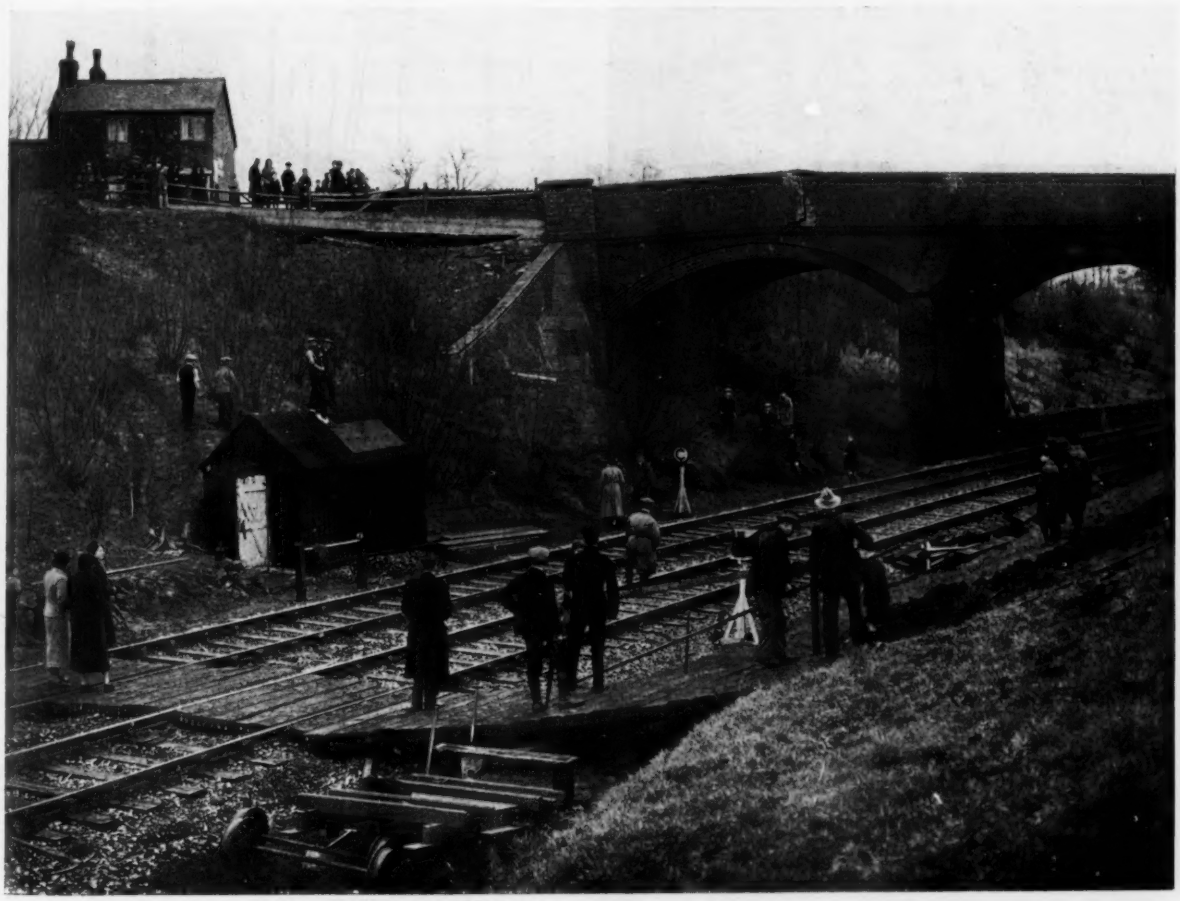


Crossed Prism Test. On the left the prisms are seen in the position in which the 20-ton load is applied, and, on the right, the marked indentation of the untreated rail will be noted

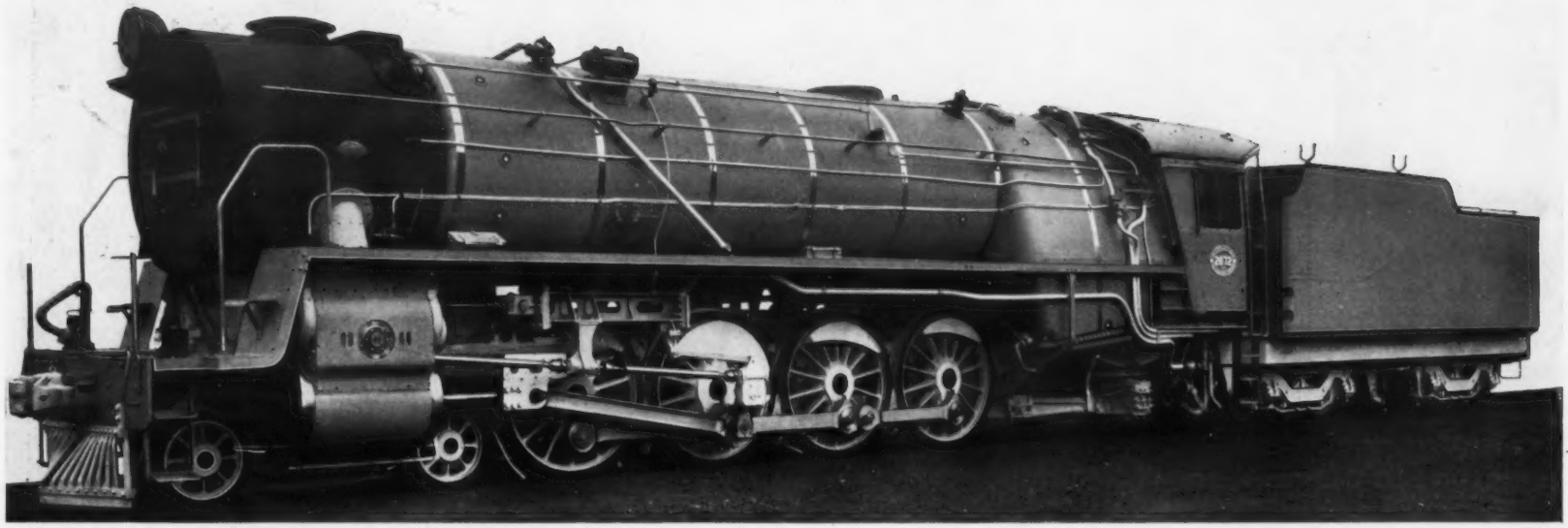
user, it would appear to offer a solution to the very urgent problem of rail wear.

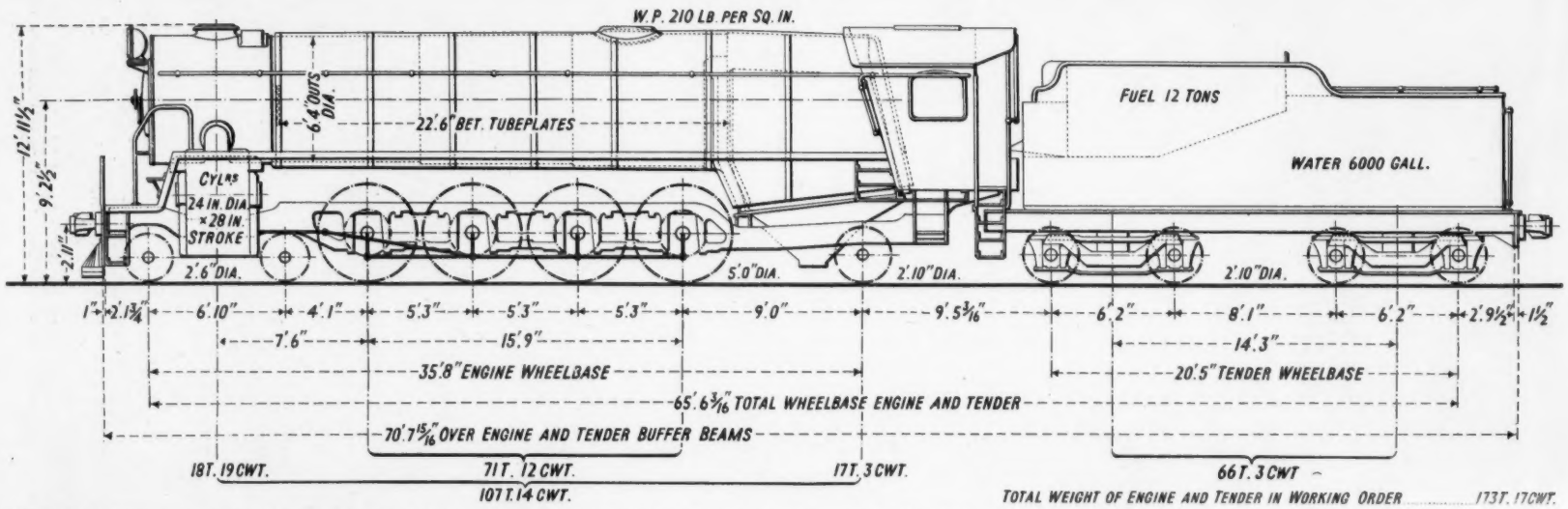
In this connection it may be noted that the Southern Railway, on which the intensive traffic of the electrified services necessitates the use of rails with a maximum of wear resistance, after trial lots laid down in 1933, ordered 10,000 tons of Sandberg Regulated Sorbitic rails in each of the years 1934 and 1935. It should also be added that, whereas the present article has dealt particularly with the problem of railway rails, the need for wear resistance applies in an equal if not greater degree to tramway rails, where the cost of replacing worn rails in the track is considerably heavier than on the railway. It is not surprising, therefore, that the Sandberg Regulated Sorbitic process is also being largely used by tramways in this and other countries.

Bridge Damaged by Heavy Rains



The bridge over the Great Western Railway at Lydeway, near Devizes, one abutment—and with it part of the arch—of which has subsided as a result of recent heavy rainfall





New 4-8-2 type locomotive for the South African Railways. Built by Robert Stephenson & Co. Ltd., Darlington. Mr. A. G. Watson, Chief Mechanical Engineer

NEW 4-8-2 TYPE LOCOMOTIVES FOR SOUTH AFRICA

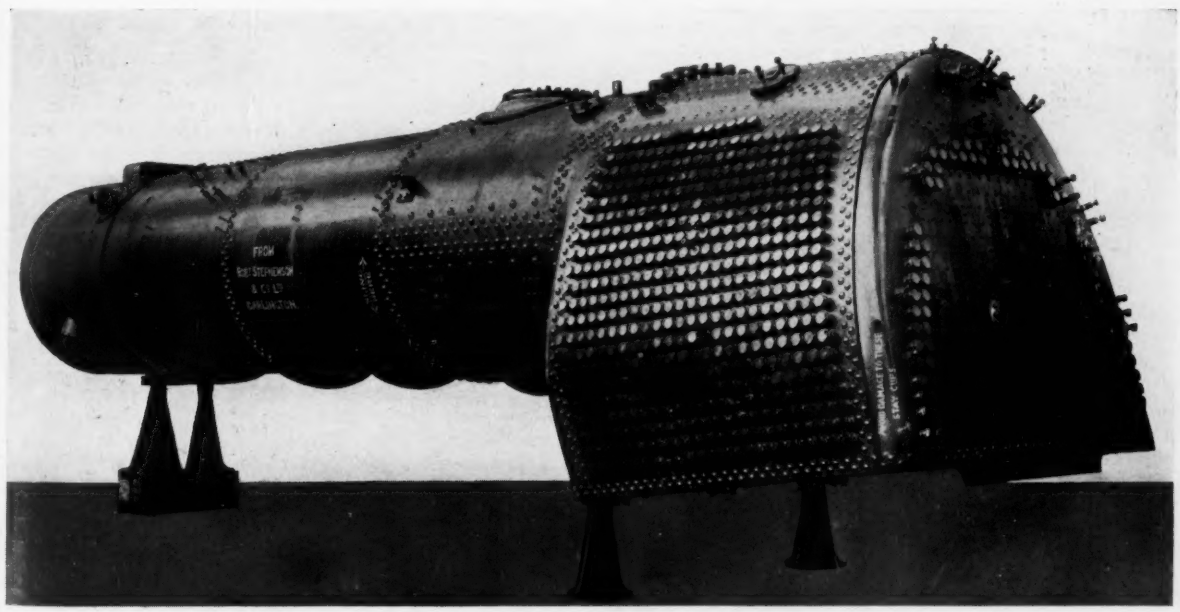
These engines, of Class 15E, have been built by Robert Stephenson & Co. Ltd., Darlington, and are the largest of the 4-8-2 type on the South African Railways

TWENTY locomotives of the class illustrated have recently been constructed by Robert Stephenson & Co. Ltd. of Darlington, for main line service on the railways of the Union of South Africa. They are intended for working heavy passenger and freight trains and, as in the case of the new Henschel 4-6-2 type express engines of Class 16E described and illustrated in our issue of November 15, 1935, these engines constitute a notable advance in size and power compared with others having the same wheel arrangement at present in use on the South African Railways. They have been built to designs prepared by Mr. A. G. Watson, Chief Mechanical Engineer, and under the supervision of Mr. T. C. Swallow, Advisory Engineer to the High Commissioner for the Union of South Africa in London. In many respects these new 4-8-2 type engines resemble the Class 16E locomotives, the cylinder castings being interchangeable, whilst the boilers, except for the length of the barrel section, which is necessarily longer owing to the more extended wheel arrangement, are of the same design.

Boiler Details

In the construction of the boiler, plates of open-hearth acid steel are used. The barrel is telescopic and built up of three courses, the foremost of which has an outside diameter of 6 ft. 4 in. The distance between tubeplates is 22 ft. 6 in., and there are 136 small steel tubes $2\frac{1}{2}$ in. outside diameter and 36 steel superheater flue tubes $5\frac{1}{2}$ in. outside diameter. The boiler barrel plate and the firebox throat plate are $\frac{7}{8}$ in. thick, whilst the wrapper and back plate are both $\frac{5}{8}$ in. thick. The inside firebox is of steel, with a thickness of $\frac{5}{8}$ in. for the tubeplate, $\frac{3}{8}$ in. for the wrapper, and $\frac{7}{16}$ in. for the door plate. The superheater is of the Melesco type with header and multiple valve regulator combined. The superheater heating surface is 661 sq. ft., and the elements are attached to the header by through bolts and spherical seatings. As the photograph of the boiler shows, the firebox is stayed over the greater part of its surface by flexible stays of S.A.R. standard type. A steam operated firedoor of the Ajax type is fitted, and the grate, which has an area of 62·5 sq. ft. is fitted with steam-operated shaking gear and a complete system of dumping grates.

The brick arch is carried by five tubes 3 in. external diameter, which contribute a further 26·2 sq. ft. to the 209·3 sq. ft. heating surface of the firebox. The tubes and flues together have a heating surface of 3,179 sq. ft., and thus the total area of the boiler heating surface, including the superheater, is as high as 4,075·5 sq. ft. The boiler is fitted with an internal steam collector of special design which terminates in a steam pipe, 7 in. diameter inside, connected to the superheater header by a spherical joint. As will be seen, the boiler is not fitted with a steam dome, the place of the latter being taken by an ample sized manhole on the hind barrel section. Two Gresham & Craven No. 13 injectors, placed under the driver's platform, supply water at the front end through a top feed clackbox, and two Ross pop valves $3\frac{1}{2}$ in. diameter, adjusted to blow off at a working pressure of 210 lb. per sq. in. are fitted. Two blow-off cocks of the Hopkinson parallel slide type are provided, and a Diamond soot blower is fitted on the back of the firebox. The cocks and valves for the auxiliaries are carried on two turrets placed on the top of the firebox, and are fed from the



Boiler of new locomotive showing special firebox staying system

collector by copper pipes. The boiler and firebox are covered with Alfol lagging.

Cylinders and Motion

Each cylinder is cast integrally with half of the saddle supporting the circular smokebox, and so designed that the castings are interchangeable. In order to make the cylinders interchangeable with Class 16E, a cast iron liner, 4½ in. thick, had to be fitted between the smokebox and smokebox saddle.

Steam distribution is effected by means of the A.L.E.-R.C. poppet valve gear and several component parts of this gear are identical to and interchangeable with corresponding parts fitted to the 4-6-2 type express engines of the 16E class.

The camshafts are arranged to give admission rates ranging between 15 per cent. cut-off to 85 per cent. in full gear. When in mid-gear the valves are all open, and a by-pass position is provided for use when drifting. The whole of the cam and operating gear is lubricated by oilbaths, while the valve spindles and cylinder barrels are supplied with oil from a Wakefield Eureka lubricator in the cab. The cylinder barrels have cast iron liners, and the steam and exhaust valve seatings are renewable.

The pistons are of the Wota type and the crossheads are interchangeable with those of the 16E class. These crossheads were illustrated and described on page 331 of THE RAILWAY GAZETTE dated February 22, 1935. The connecting rods, which are made from forgings of Supertough heat-treated steel, are of fluted section, designed for lightness consistent with strength. The coupling rods are of C class steel. The bearings at the main crank pins and coupling rod pins are fitted with floating bronze bushes. All the crank pins are hollow bored. Grease lubrication is used for the motion pins and Franklin type grease cellars supplied by Whitelegg & Rogers are installed in the axleboxes.

Balancing and Springing

Twenty per cent. of the reciprocating masses are balanced, and the wheel balancing crescents have cavities cast in them in such a manner that they may be filled with additional lead to the extent of 30, 40, 50 or 60 per cent. of the reciprocating parts, as may be found desirable in practice. The leading four-wheeled bogie is of the swing-link type controlled in the transverse direction by laminated springs. Springing at the coupled wheels is effected by overhung laminated springs imposed upon the saddle type pedestals usual with bar frames. A Cole pattern two-wheeled truck takes the weight at the rear, and the spring suspension is equalised throughout the coupled wheelbase and continued through to the truck by equalising beams pivoted in brackets bolted to the frame. The main frame plates, each made in one piece machined from solid rolled slabs, are reduced in thickness at the hind end so as to give the clearance required for the sideplay of the hind truck.

Other Equipment

A steam brake is fitted to the coupled wheels of the engine, the rigging being compensated, and working in conjunction with the vacuum brake fitted to the tender. The couplers are of the Alliance type both on the front of the engine and back of the tender. The intermediate buffing gear is of an unusual type, being in the form of a hook, on the end of which is a loose pad which bears on a wearing plate fixed in the engine hind drag casting. The latter is designed to form an oilbath for the wearing plate and pad. At the front of the tender the buffer engages with a laminated spring, working in the guides of a heavy steel casting and secured thereto by links and pins.

The whole of the electric lighting equipment was supplied by J. Stone & Co. Ltd., and the Teloc speed indicators and recorders, driven from the trailing wheel by a flexible armoured shaft, were supplied by the Hasler Telegraph Works.

The tenders are generally similar to those for the 19C and 16E types, with a tank capacity of 6,000 gallons and fuel capacity of 12 tons of coal.

The following are the leading particulars of the new 15E engines, to which for the purpose of comparison have been added the corresponding figures for the earlier 15CA 4-8-2 class engines:—

	15E	15CA
Cylinders, dia. and stroke	24 in. × 28 in.	24 in. × 28 in.
Valve type	Poppet	Piston
,, dia., inlet	8 in.	
,, ,, exhaust	9 in.	
Tractive force at 75 per cent. boiler pressure	42,336	42,440
Tractive force at 85 per cent. boiler pressure	47,980	48,090
Wheels, dia.—		
Leading bogie	2 ft. 6 in.	2 ft. 6 in.
Coupled	5 ft. 0 in.	4 ft. 9 in.
Trailing truck	2 ft. 10 in.	2 ft. 10 in.
Boiler—		
Smallest dia. outside	6 ft. 4 in.	6 ft. 4 in.
Length between tubeplates	22 ft. 6 in.	20 ft. 0½ in. with combustion chamber
Heating surface—		
Tubes, large	1,165 sq. ft.	866 sq. ft.
,, small	2,014 ,,	1,688 ,,
Brick arch tubes	26·2 ,,	23 ,,
Firebox	209·3 ,,	198 ,,
Total evaporative	3,414·5 ,,	2,775 ,,
Superheater	661 ,,	690 ,,
Total combined	4,075·5 ,,	3,465 ,,
Grate area	62·5 ,,	48·3 ,,
Boiler pressure, lb. per sq. in.	210	200
Weights in working order :—	Tons Cwt.	Tons Cwt.
On leading bogie	18 19	19 14
,, coupled axles	71 12	71 3
,, truck	17 3	15 6
Total engine	107 14	106 3
Tender capacity, coal	12 0	12 0
,, weight, full	66 3	67 6
,, ,, water, gall.	6,000	6,000

It is interesting to compare the increase in capacity of the new engines with that of the previous 15CA class. The coupled wheels are 3 in. larger, but the increase in boiler pressures compensates for this, so that the tractive force is virtually the same. The larger wheel will therefore give proportionately increased speeds without diminution of loading capacity, or conversely increased haulage capacity at the same speeds. The grate area has 29·4 per cent. and the heating surfaces 17·6 per cent. increase.

The above increases of capacity are obtained with practically no increase in the light weight as compared with the 15CA class, as the additional full weight is mainly composed of the increased weight of water due to the larger boiler.

There is no combustion chamber to the firebox, the latter now being of normal deep design, and this should reflect favourably upon the cost of upkeep and repairs.

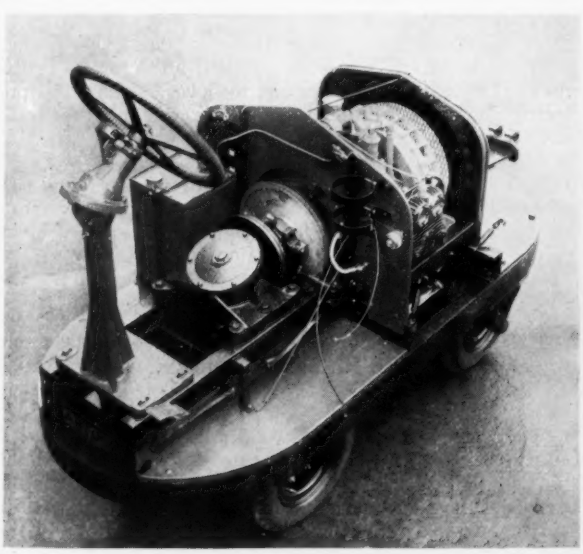
The boiler centre is 9 ft. 2½ in. from rail level, which height exceeds that of many main line locomotives in this country, and the decision to raise the boiler to this height on the 3 ft. 6 in. gauge in order to secure the above advantages is indicative of the courageous and far-seeing policy on the part of the railway administration.

A NEW STATION PLATFORM TRACTOR

The Abtus truck is an easily-manoeuvred unit capable of hauling a five-ton load at low maintenance cost

A NEW design of light mechanical truck for platform work has recently been developed by the Abtus Permanent Way Equipment Company at its Hornsey works. The special features are simplicity in operation and exceptional agility in manœuvring. The truck is driven by a robust two-cylinder, air-cooled, 10 h.p. petrol engine, which in normal circumstances will haul the specified five-ton load at about 1,000 revolutions per min. This low running speed obviates the excessive vibration usually associated with low-power engines. Transmission is by means of a simple clutch and series of bevel gears to the front pair of wheels, which are also the steering wheels. There is no intermediate gearbox. The truck is driven, therefore, solely on the clutch pedal, which, being linked with the brakes, has the advantage of a dead-man device. The speed is controlled by a motor-cycle type throttle finger control.

To run the truck in reverse, the steering wheels, which are on a centre pivot, are turned right about. It is this arrangement which makes the truck so easy to manœuvre. A small indicator at the top of the steering column shows the driver in what direction the truck will move at any given moment. As the tractor is designed for use in confined spaces, a thick rubber bumper is provided round the sides of the truck. The overall length is 6 ft. 8 in., and the width 3 ft. 2 in.; within these dimensions the truck can complete any movement. A small platform is provided at the rear, but the truck is designed primarily for use as a tractor. The petrol tank of 4 gal. capacity is detachable, and a spare is sent out with every truck. This is considered a particularly useful feature as it enables rapid refuelling without the loss of time involved in returning to a store. It is estimated that in normal conditions the truck may be run for three hours on one gallon of petrol. Experience has also shown that the comparative massiveness of the engine reduces replacements to a minimum. Either pneumatic or cord tyres are fitted as required.

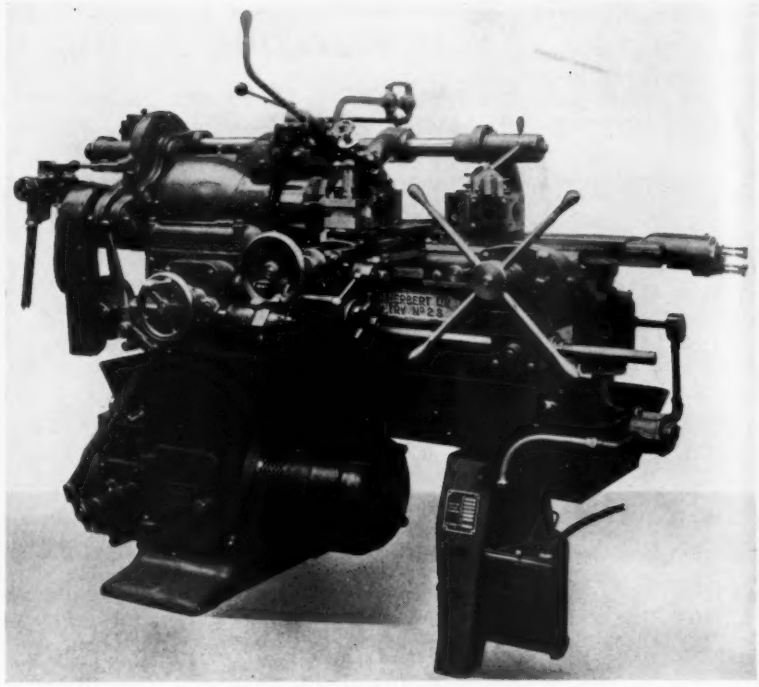


Two views of the Abtus truck, showing (left) the arrangement of the engine and transmission gear, and (right) the tractor ready for use. In both these illustrations the rubber bumper, shown in the picture at the head of the article, is missing

NEW MACHINE TOOLS IN RAILWAY SHOPS

A Herbert capstan lathe and a Richards vertical slot drilling machine

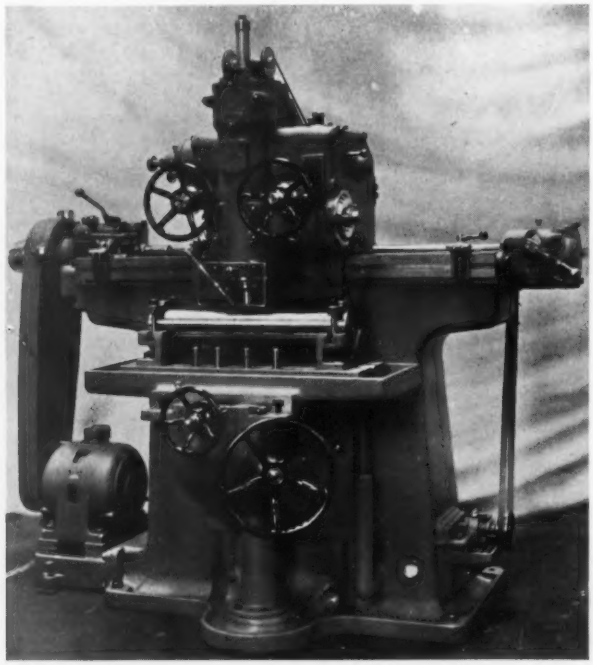
AMONG the new machine tools recently installed in railway works are the two illustrated herewith. The first is the No. 2SC capstan lathe of Alfred Herbert Limited, Coventry. It is a special modification of the Herbert No. 2S lathes for dealing with external or internal chasing. The machine will deal with all types and sizes of mud plugs and fusible plugs and is self-contained and easy to instal in any position. The chasing equipment is designed for straight or taper chasing on external or internal diameters up to 3 in. in length. Right-hand chasing is accomplished with the lathe spindle reversed, and the taper travelling away from the headstock, thus avoiding any danger of accidentally running the chaser into the chuck. The chasing bar is rigidly supported in three brackets, and the spring inside bar assists in returning the chasing bar to the starting position. The leader is supported by a housing bolted to the left hand end of the lathe, the shaft being mounted on ball bearings and driven from the spindle by 2:1 reduction gearing, which is fully enclosed and lubricated by a grease gun. Hardened and ground gear teeth ensure silence in operation and long life at high speeds. The chasing tool is carried in the tool holder held in a slide bolted to the chasing arm, and an adjustable stop is provided for setting to the full depth of the thread.



Modified Herbert capstan lathe for external or internal chasing

In operating this machine the chaser is brought to the work by means of a long lever, and the roller on the front of this lever makes contact with the former bolted to the chasing bracket. For internal chasing a second former is fitted to the top of the bracket, this governing the height to which the tool can be raised inside the work, thus preventing the chaser fouling the opposite side of the hole. The Herbert patent Duo-rate cross slide, which provides fast and slow feed, is fitted, and changes can be made instantly by a finger control lever. Two stops protected by a light hinged cover are fitted to the cross slide in each direction, and six stops are provided for the longitudinal movement of the saddle.

This lathe, as stated, will deal with all types and sizes of mud and fusible plugs. The taper is turned by means of a special taper turning tool which carries a revolving centre operating a rack and pinion.



Vertical slot drilling machine at Doncaster works, L.N.E.R.

Richards Vertical Slot Drilling Machine

This machine, which we inspected at the Doncaster works of the L.N.E.R., is seen in the second illustration, and represents the latest development in vertical key-seating machines; it embodies the maker's "one-cut" system. No previously drilled hole is required, as the cutter sinks to depth and is automatically changed into horizontal feed, thus cutting the groove or keyway to any desired length and depth at one cut. The machine is of very robust construction and the operations are performed rapidly and smoothly, the work being produced to the highest degree of accuracy. The spindle is carried in the spindle frame, which slides along the main frame

of the machine and has an ample front bearing of the double cone type. The spindle nose has an internal taper to receive a spring collet, which is closed by a nut at the top of the spindle. Only one size of collet is used, smaller size shanks being accommodated by split bushings. The vertical feed sleeve to the spindle is of generous dimensions to absorb the multitude of small shocks received by the cutter, and as the fit of the spindle in its sleeve is of the utmost importance, effective provision is made for adjustment when required. Six rates of feed are provided in both the vertical and horizontal directions, these being arbitrarily arranged with the down feed considerably finer than the longitudinal one. The down feed is tripped at an exact depth by bringing the cutter to touch the work and then setting the feed disc at the right hand side of the spindle frame to whatever depth is required. and a second fixed dial is provided to enable the operator to see at a glance the position of the spindle relative to its minimum and maximum projection.

Longitudinal feed is set by moving a clamp carrying a finely divided rule along the slide in the main frame, and clamping when the desired traverse is opposite the index mark attached to the spindle frame.

Hand feed in both the vertical and horizontal directions is provided to the spindle by conveniently placed handwheels, and the table is adjustable for height by a handwheel and has, in addition, a small cross adjustment for irregular work or work in special jigs. The machine is fitted with a gearbox providing nine changes of speed through two sets of triple sliding gears, and can be driven along by single pulley or direct motor drive. Starting and stopping is effected by means of a friction clutch.

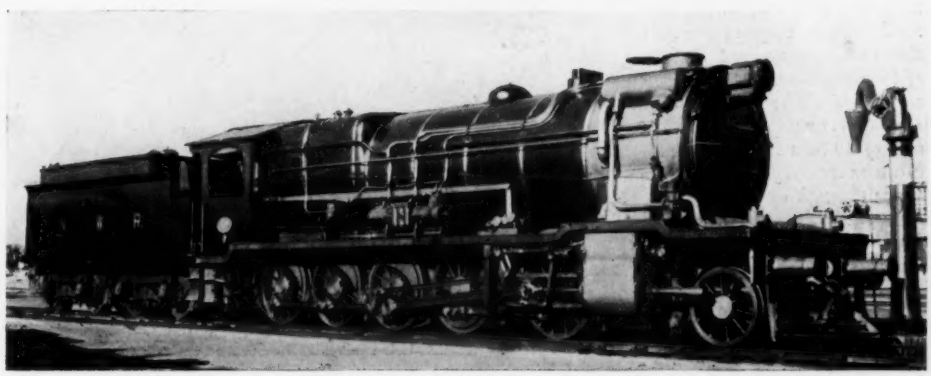
STAYBOLT LEAKAGE IN LOCOMOTIVE FIREBOXES

(From a correspondent)

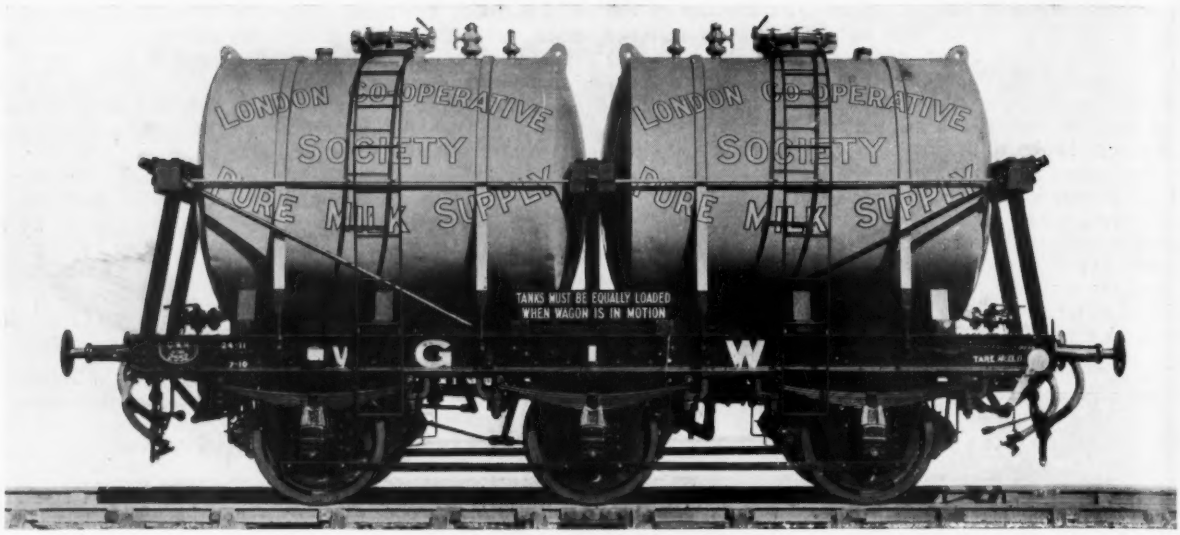
STAYBOLT leaks and corrosion at the ends of the stays in the lower sections of copper locomotive fireboxes are due to excessive softening of the conventional grades of staybolt and plate material under the influence of the working temperature prevailing in this part of the firebox. The bending stress on the stays causes plastic deformation in the inner and outer threads, which enables water to trickle past the stay ends into the firebox. Unless the stays are a tight fit in the plates, deposits of scale readily form around the ends and widen the amount of clearance and this, in turn, engenders a progressive advance of leakage and corrosion.

This is a matter which has received a large amount of attention both in this country and abroad and it has been found on the German State Railways that the trouble was reduced to a considerable extent when side plates of Kuprodur, a copper alloy suitable for hardening, were introduced for copper fireboxes, the result being that the life of the firebox plates and stays was more than doubled. This material can be heat-treated to give it the same strength as steel, and there is no difficulty in welding it to standard firebox copper plates. Corrosion resulting from flue-gases is about one fifth of the average experienced with standard copper, and the increased rigidity prevents bulging between the stays. In this connection it is of interest to note that the problem of keeping the staybolts tight has been definitely solved by the use of what is known as Henschel " drifted " staybolts in company with the Kuprodur plates. This form of stay has a soft iron core with a copper coating which is intimately bonded to the core by a patented process, and extends the whole length of the shank as far as the threaded ends, the copper coating being removed from the latter where they actually engage with the threads in the plates in order to avoid plastic deformation. Tests made in actual service on the German State Railway and other administrations with this type of stay in plates manufactured of the special copper referred to, have demonstrated complete and permanent tightness, whilst the life-time of the components has been quadrupled as compared with the use of standard copper stays in the Kuprodur plates.

The first engine to be equipped with these stays was put into service in 1930 and has now covered 400,000 km. with no noticeable wear on the steel ends of the copper armoured stays, whereas the staybolts of the ordinary kind fitted at the same time have been replaced for a second time. It has further been demonstrated that the Henschel stays are superior to steel stays of similar type in that their anti-corrosion properties under permanent bending stress are considerably higher, so that stay breakage is definitely eliminated; another advantage over steel stays is the complete absence of corrosion in the water space. The stays are screwed into the boiler plates with scanty clearance in the threaded portion, and tightened by drifting both ends with parabolic mandrels, using a pneumatic hammer with mandrel re-tracting device. In most cases it is not necessary to bead the heads over on the inner firebox, and this, of course, effects a considerable saving in time, and simplifies the process considerably. A special staybolt department is in operation at the works of Henschel & Sohn A.G. at Kassel.



Right: **2-10-0** *type* **4-***cylinder* ***N class locomotive. North Western Railway India, fitted with A.C.F.I. feed water heater.*** *(See news article on page* **79***)*



British Freight Rolling Stock

VII.—Food Transport by Rail

The accompanying illustrations show representative vehicles used by the British railways for handling two classes of the traffic in foodstuffs, the volume and importance of which was emphasised by Sir Harold Hartley, Vice-President, L.M.S.R., in a paper which was published in the issues of "The Railway Gazette" from July 26 to August 16 inclusive. The twin milk tank wagon of the G.W.R. in the first illustration is a type in increasing demand by dairy organisations, and twelve new undercarriages for these vehicles were built at Swindon in 1935. For bulk conveyance of grain, mainly between ports and mills, all-steel hopper wagons provide the most convenient method of loading, transport, and discharging. The G.W.R. and L.M.S.R. examples shown are both of 20 tons capacity. The grain is loaded from a boat or barge through openings at the top provided with doors, and it is automatically discharged into hoppers or conveyor belts

RAILWAY NEWS SECTION

PERSONAL

L.M.S.R. Appointments

The following appointments have been approved by the directors:—

Chief Commercial and Chief Operating Managers' Departments

Mr. A. Halsall, Goods Agent, St. Helens, to be Joint Goods Agent, St. Helens (L.M.S. and L.N.E.R.).

Chief Mechanical Engineer's Dept.

Mr. P. A. Buchan, Inspector (piece-work, costing and initial examination), Horwich, to be Assistant to Works Superintendent, Horwich.

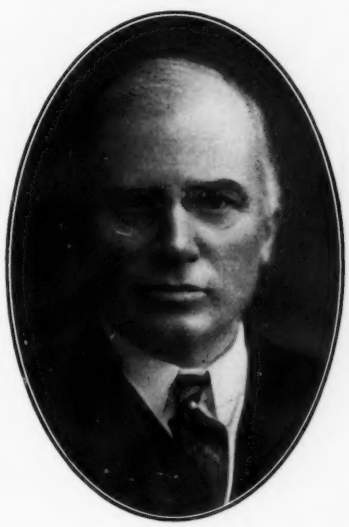
Research Department

Mr. H. O'Neill, Research Metallurgist to the Chief Metallurgist, Derby.

Mr. David Blee, who, as recorded in our issue of January 3, has been appointed to succeed Mr. W. H. Hall as District Goods Manager, Shrewsbury, Great Western Railway, joined that railway in 1916, in the Goods Rates Department at Paddington, and, apart from a break of two years with His Majesty's Forces, remained at headquarters until 1933. During this time he came into contact with every section of the goods headquarters office, especially in his capacity as Secretary to the late Mr. E. Ford and to the present Chief Goods Manager. In 1933 Mr. Blee was transferred to Slough as Goods Agent, and in 1934 took up a temporary position as Chief Clerk to the Exeter District Goods Manager. In December, 1934 he was appointed Assistant in the London District, which post he vacates to go to Shrewsbury.

Mr. D. Blee

Appointed District Goods Manager, Shrewsbury, G.W.R.



Mr. Daniel Willard,

President of the Baltimore and Ohio Railroad since January, 1910

On January 15, Mr. Daniel Willard completes his 26 years as President of the Baltimore & Ohio Railroad, a notable event in itself, but one which is more remarkable in view of the fact that, as recorded in our issue of December 13 last, he has also beaten Mr. Garrett's record in holding the chief executive office of the railroad for over 25 years, 10 months, and 9 days. He was re-elected President for his 27th term of office last month, after a continuous active railway service of over 56 years. Mr. Willard began his career as a platelayer on the Central Vermont Railroad as soon as he left school, and during the succeeding 30 years was employed on the former Connecticut & Passumpsic River, Lake Shore & Michigan Southern, Soo, Erie & Chicago, Burlington & Quincy Railways, and finally the Baltimore and Ohio system. It was on January 15, 1910, that he became President of the latter. In 1920 he was appointed Chairman of the Advisory Committee of the Association of Railway Executives, and in 1921 was elected Chairman of the Board of Directors of the American Railway Association. He is now a member of the board and of the Executive Committee of the Association of American Railroads, and of the American Telephone & Telegraph Company, and a member of the board of the Mutual Life Insurance Company. In 1916 Mr. Willard was appointed by President Wilson as a member of the Advisory Commission of the Council of National Defence, and when the commission was organised, he was elected Chairman, serving as such during the period of the war. He was also appointed Chairman of the War Industries Board by President Wilson in 1917. He is President of the Board of Trustees of the John Hopkins University, and has received honorary degrees of 10 other universities and colleges.

Mr. R. Marshall, who, as announced in our issue of December 20, has been appointed District Goods and Passenger Manager, Ayr, L.M.S.R., joined the Caledonian Railway as a telegraphist in a signal box at Greenock in 1891. After gaining varied clerical experience in different grades and at different stations between 1893 and 1897, he was appointed to the train running staff and excursion sections of the District Traffic Superintendent's Office at Glasgow, Central, in the latter year. For ten years (1901-11) Mr. Marshall acted as a relieving stationmaster on the Western District. He was then transferred to the Audit Department as a station accounts inspector, and in 1914 was appointed Assistant Stationmaster, Glasgow, Central. Four years later he was promoted to be Chief Assistant to the Western District Superintendent, with headquarters at Glasgow, Central. At the time of the amalgamation, January, 1923, he was appointed Staff and General Assistant to the General Superintendent, Northern Division, L.M.S.R., becoming Outdoor Assistant three years later. It was in June, 1931, that Mr. Marshall was promoted to be District Goods and Passenger Manager,

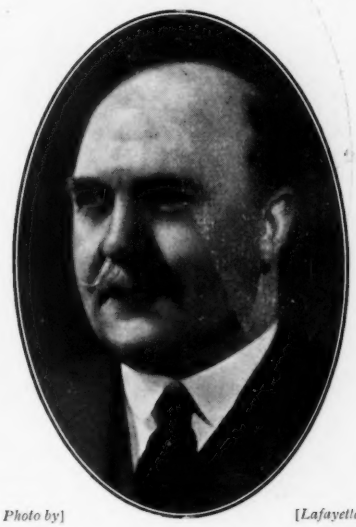


Photo by [*Lafayette*

Mr. R. Marshall,

Appointed District Goods and Passenger Manager, Ayr, L.M.S.R.

Edinburgh, the position he now vacates to go to Ayr in a similar capacity.

We are officially informed that Lt.-Col. F. C. C. Balfour, C.I.E., C.B.E., M.C., Representative of the Peruvian Corporation, is retiring from that position, and will be succeeded by Mr. F. F. Hixson, M.Inst.C.E., General Manager of the Central Railway of Peru.

Colonel Balfour was educated at Eton, and joined the Public Works Department of the Sudan Government in 1906, but was transferred to the Political Service in 1912. During the war he served in the 6th (T.F.) Battalion of the Northumberland Fusiliers, retiring in 1917 with the rank of Lieutenant-Colonel. He was in Mesopotamia from 1917 to 1920, and in 1919-1920 was Military Governor of Baghdad. Colonel Balfour was Military Secretary to the Governor of Madras, Viscount Goschen, from 1924 to 1926; Deputy-Governor of the Red Sea Province, 1926-27; and Governor in 1927-28. He was appointed Governor of Mongalla Province in 1929, and in May, 1931, was appointed to succeed Brigadier-General A. S. Cooper, C.B., C.M.G., as Representative of the Peruvian Corporation.

Mr. Frank Frederick Hixson, M.Inst.C.E., who has been appointed to succeed Lieut.-Colonel Balfour as Representative of the Peruvian Corporation, spent 12 years in London, South Africa and Manchester on various engineering works, followed by 22 years' experience in railway and bridge construction and maintenance work in South America, for the last 17 years as Chief Engineer of the Central of Peru Railway, the highest standard-gauge line in the world. In January, 1934, he was appointed to succeed Mr. M. Y. Grant as General Manager of the railway. He was elected a Member of the Institution of Civil Engineers in 1930.

Mr. D. G. Hoppins, who, as announced in THE RAILWAY GAZETTE of of January 3, has been appointed Traffic and Marine Agent, Weymouth, G.W.R., began his career with that railway at Plymouth Docks in 1902. After gaining varied experience in different sections of the Marine and Docks Department, he became head of the Cargo Department in 1912. Ten years later he was transferred to the Goods, but returned to the Docks Department as Chief Clerk in 1924. While at Plymouth he was engaged in the handling of the ocean passenger and mail traffic landed from some of the largest liners in the world. At the end of 1932, Mr. Hoppins was transferred to Newport Docks as Assistant Dock Manager, the position he now relinquishes to go to Weymouth as Traffic and Marine Agent responsible for the running of the G.W.R. Channel Islands services.

Mr. A. J. Hogg has retired from the position of Traffic Superintendent, Isle of Man Railway.

Mr. H. T. Penny, Passenger Agent, Liverpool, has been appointed to succeed Mr. F. Bramley as Canadian Pacific Railway Agent for Northern Ireland.

M. Godfernaux, a Director of our contemporary, the *Revue Générale des Chemins de Fer*, has, at his own request, been relieved of the duties of directorship, and has been appointed a member of the editorial staff and an Honorary Director.

Mr. J. A. Goudge, C.B.E., Managing Director of the Buenos Ayres & Pacific Railway, and Mr. C. C. Mallet, another London Director of the same railway, arrived in Buenos Aires on December 3 on a business visit.

Consequent upon the retirement of Mr. Wilson Cross, Mr. Alexander Lowe McColl, Deputy Chairman and Joint Managing Director, since 1933, has been appointed Chairman of the Vacuum Oil Co. Ltd. Mr. H. Holliday, Joint Managing Director, is now Managing Director. Mr. McColl joined the firm in 1905, and 14 years later was elected to a seat on the board of directors. He is well known in railway, marine and other circles, and is a Director of the Superheater Co. Ltd. and other concerns.

Mr. Kenneth S. Peacock has been appointed Managing Director of Guest, Keen & Nettlefolds Limited.

Sir David R. Llewellyn, the Hon. R. Lyttelton, and Mr. J. H. Jolly have been appointed Directors of The British (Guest Keen Baldwins) Iron & Steel Co. Ltd. Sir Charles W. Wright has been appointed Chairman; Mr. Jolly, Deputy Chairman; and Mr. Charles H. Keen, Assistant Managing Director.

Mr. F. F. Hixson,
Appointed Representative of the Peruvian Corporation

Mr. D. G. Hoppins,
Appointed Traffic and Marine Agent, Weymouth, G.W.R.

Elliott [*& Fry*

Mr. A. L. McColl,
Appointed Chairman of the Vacuum Oil Co. Ltd.

Colonial Railway Staff Changes

The Secretary of State for the Colonies has recently made the following appointments:—

Mr. H. Weightman, Engineer, Nigerian Government Railway, to be Chief Engineer, Sierra Leone Government Railways.

Mr. J. R. Roberts, Assistant Traffic Superintendent, has been promoted to Traffic Superintendent, Tanganyika Government Railways.

Mr. P. J. Floyd, Traffic Manager, Great Southern Railways, has been re-elected Chairman of the Irish Traffic Officers' Conference for 1936.

We regret to record the recent death of Lt.-Col. J. C. W. Madden, D.L., a Director of the Great Northern Railway, Ireland, at the age of 65.

We record with regret the recent death of Mr. Arthur Stocks, F.C.A., Chairman of William Asquith Limited, Halifax.

At the annual general meeting of the British Steelwork Association held at Caxton House on December 19, Mr. H. B. Jacks, O.B.E., was re-elected as President, and Mr. E. Boynton, M.I.Mech.E., and Mr. A. Veitch as Vice-Presidents.

Following the appointment of Sir Charles Craven as Chairman of Vickers-Armstrongs Limited and the English Steel Corporation Limited—recorded in THE RAILWAY GAZETTE of November 22 last—and the decision to reopen the works at Darlington, Mr. A. B. Winder and Mr. A. Dunbar have been appointed joint General Managers of the latter firm, of Darlington Forge and of Industrial Steels. Mr. Winder is at present General Manager, English Steel Corporation and of Industrial Steels, and Mr. Dunbar is a Director and Commercial Manager of the English Steel Corporation, and both are Directors of Darlington Forge.

We regret to record the death, on December 30, of Colonel Sir Lawless Hepper, late R.E., who for 11 years was Agent of the Great Indian Peninsula Railway. With the death of Sir Lawless, passes one of the best known Railway Royal Engineer Officers of our time. Born in 1870 he was educated at Rossall and the Royal Military Academy, Woolwich, and was commissioned in the Royal Engineers in 1890. In 1894 he joined the Indian State Railways and was posted to the North Western system. After varied experience, his services were lent to the G.I.P.R. as Deputy Agent in 1906 and in 1911 he was appointed Agent. During his agency he was responsible for the preparation of the Bombay suburban electrification scheme and other measures of far-reaching importance, and in 1916 he was President of the Indian Railway Conference Association. Retiring from the G.I.P.R. in 1917, he was knighted in the following year; he was also a Knight of Grace of the Order of St. John of Jerusalem in England. He is perhaps best known to railwaymen the world over as the inventor of the Hepper electric locking instrument for the control from a station or cabin of ground frame keys for locking loopline or other points. After leaving the G.I.P.R., Sir Lawless was Director of Development in Bombay, 1920-26.

According to the *London Gazette* of December 27, the King has been pleased to award the Imperial Service Medal to 46 employees of the Department of Railways and Canals, Canada.

From the *London Gazette*: The King has been pleased to issue a New Commission of Lieutenancy for the City of London, bearing date November 8, 1935. In the list that follows are:—

The Rt. Hon. Viscount Wakefield, C.B.E.
Sir Charles Batho, Bt. (Director, L.N.E.R.).
Sir Henry D. Kimber, Bt. (Director, South Indian Railway).
Sir A. Garrett Anderson, G.B.E. (Director, L.M.S.R.).
Mr. Walter K. Whigham (Director, L.N.E.R.).
Mr. Charles J. Hambro (Deputy Chairman, G.W.R.).
Sir Josiah C. Stamp, G.C.B., C.B.E., D.Sc. (Chairman and President of the Executive, L.M.S.R.).
The Rt. Hon. Lord Palmer (Deputy Chairman, G.W.R.).
Lord Ritchie of Dundee (Chairman, Port of London Authority).
Sir Francis H. Dent, C.V.O. (Chairman, Railway Clearing House and Director, Southern Railway).
Sir Herbert A. Walker, K.C.B. (General Manager, Southern Railway).
The Rt. Hon. Lord Plender, G.B.E. (Shareholders' Auditor, G.W.R.).
Col. the Hon. J. J. Astor (Director, G.W.R.).

FRENCH RAILWAY STAFF CHANGES

M. Surleau, Chief Engineer, Way and Works, State Railways, has been appointed General Manager, Alsace-Lorraine Railways.

M. A. Porchez has succeeded M. Surleau as Chief Engineer, State Railways.

M. Jean Levy has been appointed to succeed M. Nasse as Chief Mechanical Engineer, State Railways.

Monsieur Armand Porchez was a pupil at the Ecole Polytechnique and entered the State Railways service in 1921, where he occupied successively the following posts: District Engineer at Rouen and at St. Lazare, Paris; Assistant to the Permanent Way Engineer; and Chief Assistant for Permanent Way. As a member of the National Public Works Commission to Combat Unemployment, M. Porchez has been concerned, together with MM. Dautry and Surleau, in carrying out the important programme of works in and about Paris, as well as the extension and modernisation of the maritime stations at Havre, Cherbourg, &c. He is a Chevalier of the Légion d'Honneur.

Monsieur Jean Levy was a pupil at the Ecole Polytechnique and at the Ecole du Génie Maritime, where he subsequently became senior engineering instructor from 1924-29. In the latter year he entered the State Railways service and there occupied successively the following posts: District Locomotive Superintendent; Assistant for Electric Services; Chief Assistant for Rolling Stock; and Assistant Chief Mechanical Engineer. He was selected to fill the post of Chief Mechanical Engineer on October 1, 1935, to take effect on the retirement of Monsieur Nasse. He is a Chevalier of the Légion d'Honneur.

INDIAN RAILWAY STAFF CHANGES

Mr. B. Moody, who until recently was officiating as Secretary to the Railway Board, has been granted one year's leave, as from October 21.

Mr. J. Scruby has been appointed to officiate as Deputy Chief Engineer, N.W.R., as from October 25.

Mr. R. T. Power, Officiating Traffic Manager, Burma Railways, reverted to his substantive post of Deputy Traffic Manager, on October 30, and subsequently has been granted eight months' leave, as from November 22.

Mr. R. B. Jennings has been appointed Acting Deputy Manager (Staff), B.-N.R., as from November 28, vice Mr. A. R. Ubsdell, granted leave from that date.

Dr. A. M. Leake, V.C., Chief Medical Officer, B.-N.R., returned from leave and resumed his duties on October 8.

Mr. E. B. Robey, Senior Government Inspector, No. 1, has been granted 1¾ months' leave preparatory to retirement as from November 7. Mr. H. A. Joscelyne has been appointed to officiate in his place from that date.

Mr. E. L. Manico, Officiating Deputy Chief Operating Superintendent, N.W.R., has been granted leave for 10¾ months, as from December 1.

Mr. J. H. Bavin, Chief Auditor, A.B.R., returned from leave and assumed charge of his duties from Mr. N. H. Lewis, Acting Chief Auditor, on November 15. Mr. Lewis reverted to Deputy Chief Auditor on that date.

Mr. P. C. Chaudhri has been appointed Deputy Chief Accounts Officer, E.B.R., as from October 19, 1935.

Mr. C. E. Hall has been appointed to officiate as Deputy Chief Accounts Manager, G.I.P.R., as from November 27.

Mr. J. T. Day, on return from leave, resumed duty as Deputy Traffic Manager, G.I.P.R., on October 12.

Mr. G. W. D. Beaman has been appointed to officiate as Deputy Traffic Manager, Commercial, Burma Railways, as from October 29.

Mr. Reginald F. Clayton, Director of Karrier Motors Limited, resigned his seat on the board of that firm on December 31. Well known in commercial motor vehicle circles, Mr. Clayton was a joint founder, with Mr. H. F. Clayton, of the firm in 1907, and for the past quarter century has been responsible for much commercial vehicle pioneering work. Some of the most striking productions by the Karrier Company under his direction were: the mechanical horse, the rigid framed six-wheeler for goods and passenger work, the mechanical street sweeper and collector, and the road-rail vehicle. He is also a Director of Clayton & Co. Ltd., Penistone, the makers of detonating placers and railway signal appliances.

From the *London Gazette* of January 3: Regular Army, Supplementary Reserve of Officers, Royal Corps of

Signals: Major R. Tandy to be Bt. Lt.-Col. as from January 1. Col. Tandy is the Officer Commanding No. 2 Company, L. of C., Royal Signals, S.R. (L.M.S.R., Telegraphs). He is in the Electrical Engineer's Department of the L.M.S.R.

Mr. S. P. Flowerdew, V.D., who, as recorded in THE RAILWAY GAZETTE of January 3, has been awarded a C.B.E. in the New Year Honours List, was born in 1881, and received his training at the Royal Indian Engineering College, Coopers Hill. He was appointed an Assistant Engineer on Indian State Railways in 1902, and was promoted to be Executive Engineer in 1910. In 1917 he was appointed Assistant Agent of the North Western Railway, and later in the same year became junior Deputy Agent. In March, 1925, Mr. Flowerdew was appointed to officiate as Divisional Superintendent, and was promoted to the rank of Superintending Engineer in the following year. In 1927 he was appointed Officiating Chief Engineer, East Indian Railway, an appointment in which he was confirmed in June, 1928. In December, 1929, he became Officiating Director of Civil Engineering, Railway Board, and retired from service in India in July, 1932. Subsequently he has been employed upon construction and other works in South-East Africa, and it is for this work, and in particular for that upon the northern extension of the Nyasaland Railways—of which he was in charge—for which he has been awarded the C.B.E.

Mr. R. A. P. Setterfield, Catering Superintendent of the Cunard White Star Line, has been appointed by the Great Western Railway Company to be Manager of its hotels and catering service in succession to Mr. G. J. Walker who is retiring next June. Mr. Setterfield will continue in his present position until after the first voyage of the *Queen Mary* in May next.

From the *London Gazette* of January 3: The King has been graciously pleased to sanction the appointment of Lt.-Col. H. H. Mauldin, Lt.-Col. V. M. Barrington-Ward, D.S.O. and Dr. (Mrs.) C. E. M. Berridge, M.B., as Officers of the Venerable Order of the Hospital of St. John of Jerusalem. Cols. Mauldin and Barrington-Ward are Superintendents of the Eastern and Western Sections, respectively, Southern Area, L.N.E.R.; and Mrs. Berridge is Lady Divisional Superintendent, Moghalpura Nursing Division, North Western Railway Corps (India).

New Year Message of Sir Edward Beatty, President, C.P.R.

Since 1936 coincides with the fiftieth anniversary of the inauguration of the Canadian Pacific Transcontinental Service, and follows closely on the fiftieth anniversary of the driving of the last spike at Craigellachie, B.C., the officers and employees of our company have particular reason to realise the fine traditions and rich heritage which have become theirs through fifty years of united effort on behalf of this great Dominion. While in recent years our railway and steamship services have shared in a world-wide setback in business conditions, the New Year seems to coincide with a gratifying renewal of confidence and offers prospect of genuine improvement likely to be reflected in traffic and earnings. There are problems still to be solved, but we have a right to be cautiously optimistic of an upward trend in the coming year. I am particularly appreciative of the continued loyalty, courage and efficiency of our officers and employees under trying conditions, and desire to thank them sincerely on behalf of the company for their admirable co-operation. Wishing you all, both personally and the members of your family, a happy New Year.

Slip Coach Services

Mishaps in the operation of slip coaches are in themselves rare enough, but certain circumstances connected with that involving a slip carriage for Woodford and Hinton on the 6.20 p.m. Marylebone-Bradford express, L.N.E.R., on December 19, are additionally curious. In the first place, the slip overtook the train from which it had been detached and collided with it in the rear, slightly injuring nine passengers and the guard. The express was travelling slowly at the time. Moreover, it will be seen from the table herewith of slips in Great Britain from 1875 to the present time that there are now only two slip carriage services on the G.C. section of the L.N.E.R.; it so happens that both are on the 6.20 p.m. express, and are detached at stations only 14½ miles apart. The first comes off at Finmere, while the Woodford slip, which was involved in the mishap, is a through carriage to Stratford-on-Avon via the Woodford-Byfield branch and the former Stratford-on-Avon and Midland Junction Railway (now L.M.S.R.). An editorial article in our issue of October 11, 1935, dealt with the inception and development of slip coach services in this country, and the table alongside is that which then accompanied the article, but revised to date.

The only other slips at present operated on the L.N.E.R., both on the G.E. section, are at Marks Tey off the 4.57 p.m. to Clacton, and at Waltham Cross off the 6.0 p.m. to Hertford and Bishops Stortford.

Railway	Slips Commenced	Slips Given Up	No. of Places	Greatest Number in a Year	Totals										
					1875	1880	1885	1890	1895	1900	1908	1914	1918	1924	1936
Total ..	—	—	—	—	58	88	92	122	127	129	179	200	18	93	26
G.W. & L.N.W. Jt.	1868	1894	1	2 in 1880 ..	—	2	2	1	—	—	—	—	—	—	—
G.W.R. ..	Dec., 1858	—	43	79 in 1908 ..	25	32	26	30	42	49	79	72	—	47	21§
S.E.R. ..	May, 1860	July, 1924 ..	11	11 in 1863–65	4	3	4	3	3	1	2	3	—	3	—
L.C.D.R. ..	Dec., 1872	July, 1926 ..	6	5 in 1896, &c.	3	3	3	4	3	4	3	6	—	7	—
L.B.S.C.R.	Feb., 1858	Apr., 1932 ..	11	27 in 1914 ..	3	7	8	9	9	9	14	27	2	21	—
L.S.W.R. ..	March, 1887	May, 1902 ..	—	4 in 1896, &c.	—	—	—	2	3	4	—	—	—	—	—
L.N.W.R. ..	March, 1869	Dec., 1916 ..	11	18 in 1914–15 (+1 newspaper)	2	1	1	1	—	9	16	18	—	—	—
M.R. ..	July, 1886	Dec., 1916 ..	26	25 in 1888 ..	—	—	—	19	17	5	13	21	—	—	—
Furness Rly.	July, 1887	Dec., 1916 ..	5	7 in 1891 ..	—	—	—	4	5	3	2	1	—	—	—
L.Y.R. ..	Oct., 1886	Oct., 1926 ..	7	8 in 1899, &c.	—	—	—	5	6	8	7	7	5	6	—
Caledonian	Jan., 1904	Dec., 1916 ..	9	14 in 1911 ..	—	—	—	—	—	—	12	12	—	—	—
G.S. & W.R.	June, 1898	Sep., 1901 ..	1	1 in 1899, &c.	—	—	—	—	—	1	—	—	—	—	—
G.N.R. ..	Oct., 1864	Dec., 1916 ..	12	30 in 1883 ..	15	27	27	17	9	6	1	1	—	—	—
G.E.R. ..	June, 1872	—	15	25 in 1904 ..	2	9	17	18	20	23	16	18	—	3	2*
M.S.L.–G.C.	May, 1886	—	11	11 in 1894 ..	—	—	—	6	7	1	2	4	—	2	2
N.E.R. ..	Jan., 1871	1905	3	3	1	1	1	1	1	1	—	—	—	—	—
N.B.R. ..	May, 1870	May, 1894 ..	5	3	3	3	3	2	—	—	—	—	—	—	—
Eskdale ..	July, 1921	1924	1	1	—	—	—	—	—	—	—	—	—	—	—
G.S. & W.R.	June, 1901	—	7	9	—	—	—	—	—	—	8	8	7	—	1
M.G.W.R.	1909 ..	July, 1928 ..	1	2	—	—	—	—	—	—	—	1	2	1	—
B. & N.C. (N.C.C.)	July, 1895	Sep., 1916 ..	4	4	—	—	—	—	2	2	1	1	—	—	—
G.N.R. (I.)	August, 1896	—	7	3	—	—	—	—	—	3	2	—	1	2	1†
B. & C.D.R.	Nov., 1902	Apr., 1918 ..	1	1	—	—	—	—	—	—	1‡	1‡	1‡	—	—

* Winter only (Sat. excepted); 1 in Summer. † In Summer. ‡ Saturday. § In summer, 20 Mon. to Fri., and 23 Sat.
Current (Winter) services, 1935–1936. Other columns show maximum number operated during the year

The Electrical Industry in 1935

By comparison with the reports of other years, the 1935 report on railway electrical developments in Great Britain may seem a little disappointing. Important railway contracts secured in the previous year were completed, and schemes certain to involve the placing of large contracts in the near future were disclosed, but 1935 was a relatively quiet year as regards the actual receipt of fresh orders from the railways. In other directions much new work was secured, orders for turbo-generator, rolling mill, and mining equipment having been both numerous and individually important. Orders for trolleybuses were conspicuous in the same way.

Metropolitan-Vickers Electrical Co. Ltd.

Foremost among all contracts placed in this country during 1935 for railway electrical equipment was that secured by Metro-Vick for the electrification at 3,000 volts d.c. of the Central Railway of Brazil, comprising the suburban lines out of Rio de Janeiro, the 108 km. of main line from Rio to Barro du Pirahy, and the 55-km. branch line to Santa Cruz. The contract includes 78 complete three-coach trains, 30 locomotives (9 passenger, 15 freight, and 6 mixed traffic), the whole of the overhead line and signalling equipment, and complete equipment for 5 rectifier substations and 9 track cabins. It includes also complete workshop equipment for the maintenance and repair of the rolling stock, the workshop buildings, car sheds, offices for the railway staff responsible for the electrified sections, sub-station buildings, and track cabins. The first ten trains are due to be in service in January, 1937.

In the course of the year five 1,200 h.p. 3,000-volt locomotives were ordered by the South African Government, and it was expected that the first three would be ready before the end of 1935. A further 20 were ordered later, and delivery of these is due to begin in May of this year.

Two of the six 3,000-volt locomotives for the Polish State Railways were completed during the year, and work continues in Poland on the mechanical parts for the remaining four for which the electrical equipment is in process of shipment.

The Southern Railway was supplied with equipment for 4 double trailer units ordered in May, and with 29 two-car units, each of one motor coach and one driving trailer coach, ordered in June.

Welding developments include the introduction of a 22-gauge electrode for welding thin plates and another for welding stainless steel. The latter produces an austenitic decay-proof weld not less resistant to corrosion than the parts treated. Improved welding sets have been developed and static transformer equipment is now available for welding with a.c. With the improved covered electrodes developed for this work, welding with a.c. is said to be superior to welding with d.c. both in ease of operation and in the quality of the welds.

British Thomson-Houston Co. Ltd.

This firm has in hand several important orders for rectifier transformers, one from the London Passenger Transport Board calling for a number of air blast cooled units and one from the Electricity Supply Commission in South Africa calling for eleven 1,667-kW. 88-kV. units to be used with regenerative rectifiers energising the Cato Ridge-Durban and the Glencoe-Volksrust sections of the South African Railways. Another contract received in connection with the electrification of the South African Railways was for twenty mercury-arc rectifiers for inverted operation by means of grid control, and a quantity of track high-speed circuit-breakers.

The London Passenger Transport Board ordered a further 1,500-kW. steel tank mercury arc rectifier for Holloway Road substation (making the third at this point), and three 2,000-kW. rectifiers for a new substation on Tower Hill. In hand for the same organisation are a 1,500-kW. rotary converter for Burnt Oak and two 1,500-kW. rectifiers for Hendon where a rotary converter will be displaced.

Three d.c., 26 a.c., two constant current, and four Ward Leonard electric drive equipments for excavators have been supplied to Ransomes & Rapier Limited, and Ruston Bucyrus Limited. For one excavator, to be built by the former firm for removing over-burden from the ironstone at the Corby works of Stewarts and Lloyds Limited, a 650-kVA. set was demanded.

Outstanding machine tool drive orders comprised a 50-h.p. Ward Leonard equipment for a 7 ft. × 7 ft. × 20 ft. tandem table planer with a 10 to 1 speed range, and 60/30 h.p. two-speed slipring motor equipments for wheel lathes.

English Electric Co. Ltd.

The contract for extending the electrification of the Danish State Railways in the suburbs of Copenhagen was completed in the summer, and 350 h.p. diesel-electric shunting locomotives (similar to the one which was in trial service on the L.M.S. system during 1934), were built or put in hand for the L.M.S.R., the G.W.R., the Sudan Government Railways, and the New Consolidated Gold Fields of Johannesburg.

The diesel-electric paddle vessel *Talisman* was added to the Clyde passenger fleet of the L.N.E.R. during the year, and during her trials attained a speed of 17 knots. The *Talisman* is the largest electrically driven paddle vessel in the world.

An important feature of the year was the large increase in the use of a.c. for arc welding, many equipments for which were supplied by the English Electric Co. Ltd.

The General Electric Co. Ltd.

While trolleybuses are the most prominently featured in the report on the electric traction activities of the G.E.C. during 1935, railway developments were not quite out of the picture. An entirely new type of train equipment was put in hand for experimental work on the London tube railways. The London Passenger Transport Board ordered also three mercury-arc rectifiers of a new pumpless type, and placed with the G.E.C. a contract for 11,000-volt cubicle switchgear.

Interesting automatic control schemes were worked out by the G.E.C. for the Kincardine swing span bridge over the Forth, and for a coal handling plant built and supplied by Fraser & Chalmers Engineering Works for the Lunghai Railway, China.

Nine large interlinked groups of road traffic signal equipments were installed in London by the Siemens and General Electric Railway Signal Co. Ltd., and an important contract for train describer equipment was completed for the South African Railways.

A special furnace was developed for melting out babbit metal from bearings, and several of these furnaces were made for the Indian State Railways.

Like the companies whose activities have already been reviewed, the G.E.C. supplied equipment for both d.c. and a.c. arc welding.

SPEEDY IRISH RAILCARS.—Some rapid schedules are being operated by the two L.M.S.R., N.C.C. section, railcars. The most noteworthy of these consists of running the 31 miles from Ballymena to Belfast in 45 minutes, inclusive of four stops. On a recent trip on this service we noted a very satisfactory performance by Railcar No. 1. This is fitted with two 140-h.p. Leyland petrol engines driving through a hydraulic torque-converter, and seats 62 passengers. After some smart running between stops, the journey concludes with a non-stop run from Dunadry to Belfast, 15·9 miles in 22 min. Time was kept without difficulty. The smartest run in the initial stages was from Antrim to Muckamore, 1·9 miles in 3 min., in spite of one mile rising at 1 in 196 from the start, the maximum speed being 46 m.p.h. On the final length speed was sustained at 47 m.p.h. up the 1 in 180 grade to Kingsbog Junction and rose to a maximum of 57 m.p.h. For a railcar designed for short-distance work, and without any special aids to fast running, such as streamlining, this is a good performance, while the riding at high speed was most comfortable. This particular car is covering a daily mileage of approximately 300, including four of these fast runs in each direction between Belfast and Ballymena.

Permanent Way Maintenance and the Effect of Speed

Summary of a paper delivered by Mr. W. K. Wallace, Chief Civil Engineer, L.M.S.R., to the Railway Students' Association in London, on January 9, 1936

Maintenance of track, as set out in the Statutory Accounts, Abstract "A," cost the L.M.S.R. in 1934 £3,960,000, out of a total for Abstract "A" of £6,708,000, or almost 60 per cent. of the whole expenditure under the Civil Engineer, made up of £1,154,000 for complete renewals, and £2,806,000 for repairs and partial renewals; or, say, £206 10s. a mile of the 19,000 miles of single track, or 6·6 per cent. of total traffic receipts, apart from superintendence, national insurance, workmen's compensation, and general charges.

The total staff employed directly on this work comprises 200 supervisory grades and 16,000 conciliation staff, exclusive of all the general supervisory and clerical grades not directly connected with track maintenance.

In 1934 the L.M.S.R. used 87,000 tons of rails, 1,500,000 sleepers, and 702,000 cu. yd. of ballast.

At present the L.M.S. Company has a daily total of 2,363 miles booked over 60 m.p.h., so that present day expenditure includes a certain amount due to high speed operation.

Speed has a commercial value, and the transportation services giving the most rapid transit, other things being equal, will tend to carry not only the bulk of the passengers, but also of the goods. The effect of speeding up goods transport has probably affected the permanent way as much as that of passenger trains.

American railways have suffered from competition more than railways in this country. Taking 1923 as 100, passenger revenues for 1933 in this country were 72 as compared with 29 in the U.S.A. Some spectacular high speed trains have been put on, and financial results now available show these to have proved effective.

Most of the British main lines were built before 1870 and, therefore, were not aligned for high speed running. To ensure comfortable riding, the super-elevation and speed must be in reasonable relation to each other. It is theoretically possible to run round a curve of 15 chains radius at 60 m.p.h., with 14 in. of cant, but this would be uncomfortable for slow passenger trains and unsafe for goods trains. The solution would be to provide 6 in. of cant and restrict speed to a maximum of, say, 45 m.p.h.

Before beginning operation of the Hiawatha, one of the high speed steam trains in the U.S.A., the Chicago, Milwaukee, St. Paul & Pacific overhauled the main line between Chicago and St. Paul, 410 miles. The maximum cant was fixed at 3½ in. as against 6 in. usually allowed in this country. The centre of gravity of the Hiawatha locomotive is 76·3 in. above rail level, whereas that of the L.M.S. "Princess" class is 68 in. Unrestricted speed is permitted on all curves of 1 degree (87 ch. radius) or flatter; 70 m.p.h. on curves of 1 to 2 degrees (87 ch. to 43½ ch. radius); and 60 m.p.h. on sharper curves.

If 90 m.p.h. be assumed as unrestricted speed, the L.M.S. line would permit of this on all curves down to 68 ch. radius, 70 m.p.h. to 42 ch., and 60 m.p.h. to 30 ch.

Although the C.M.St. P. & P. track was of first class construction and maintenance for ordinary running, the company had to employ 600 men, in addition to the ordinary maintenance staff, for two months, making the extra refinements in alignment.

A survey of the L.M.S. main line from Euston to Carlisle shows that the following restrictions due to curvature only would have to be made. This is exclusive of those due to stations and junctions:—

		Total length, miles
Under 60 m.p.h.	6	2¾
Between 60 and 75 m.p.h. ...	36	15½
Between 75 and 90 m.p.h. ...	34	15½
Total	76	33½

This compares with 266 miles without curvature restrictions. The table assumes 6 in. of maximum cant and a speed allowance for 7 in. of cant, *i.e.*, a shortage of cant up to a maximum of 1 in. is permissible. On the L.M.S. a maximum of 2¾ in. shortage of cant is usually allowed.

The American Railway Engineering Association publishes three tables of super-elevation:—

Equilibrium speed.—Where the resultant of forces passes through the centre line of the track.

Comfortable speed.—Where the resultant passes practically 3½ in. outside the track centre line.

Permissible speed.—Where the resultant passes practically 6 in. outside the track centre line.

In all cases, the centre of gravity of rolling stock is assumed 84 in. above rail level.

In practice, the cants for comfortable speed are 1½ in. less than for equilibrium speed and for permissible speed a further reduction of 1½ in. is made.

The older lines in this country were laid out with circular curves springing directly from straights, but with greater speed the insertion of transition curves between the straights and the circular curves became necessary.

The older lines in this country were laid out thus and so long as speeds were low little trouble was experienced. With greater speed, however, of necessity came increased cant, and the length of transition is selected so that the super-elevation is gained or lost on a reasonable gradient depending on the speed, and by this means lateral shock entering and leaving the curve is eliminated.

The insertion of transition curves in an existing line originally laid without them, built many years ago, and with many structures adjacent to or near the clearance line, is a task requiring considerable skill and ingenuity. The first essential is to obtain an accurate record showing all defects, and connecting these, as far as possible, to their causes. An instrument largely used to obtain this is the Hallade track recorder. It is primarily three sets of pendulums whose movements are recorded on a paper chart, and show:—

(*a*) Rolling—due, say, to variation in cross-level of the track.

(*b*) Side-thrust—for example, incorrect cant for the speed at which the train is running at the moment.

(*c*) Vertical movement due, perhaps, to low joints, hanging sleepers, &c.

The chart has five lines on which (*a*), (*b*) and (*c*) above are indicated, as well as a line indicating mileposts and stations and the speed at which each mile is traversed, and a line indicating curves and straights.

From a study of the charts of several runs over the same piece of line the necessary measures required to eliminate defects can be decided. Some defects can be attended to by the length gangs while others are an engineering problem and necessitate realignment. By the use of transition curves and Hallade methods steeper cant gradients are possible, as the lift is balanced by the outward thrust, and rises as sharp as 1 in. in 30 ft. give quite smooth running.

The increase in high speed running has not up to the present affected the design of permanent way materially. All the four groups are still utilising as their standard main line road 95-lb. B.S. bull-head rails in 60 ft. lengths carried in cast iron chairs weighing 46-lb., each on 24 sleepers per rail length. On the sharper curves additional sleepers are put in as necessary. The L.N.E. and L.M.S. have laid a limited mileage of 100-lb. rails within the last year or so. This is not the British Standard 100-lb. Section but the 95-lb., with 5-lb. additional per yd. on top of the head. The increase in weight is not due in any case to high speed but is to give longer life in places where the rail wear is very heavy and where at present the rails do not last out the life of the sleepers.

Short fishplates either 9 in. or 10 in. long secured by two bolts, in place of the ordinary B.S. 18 in. plate with 4 bolts, are now being much used, and appear to be quite satisfactory. The use of a short fishplate enables the joint sleepers to be closer together, thus stiffening up the joint which is usually the weak place in the road. The welding of rails into long lengths

is being tried in countries using the flat-bottomed rail which is capable of carrying much greater compressive stress without buckling than the British bull-head section. Long lengths of rail will, however, raise awkward problems when they have to be renewed.

In point and crossing work high speed has had an undoubted effect on the design of junctions; longer switches and increased radii in turnouts, leading to flatter crossings, are installed generally so as to give better running through the junctions and are a necessity for the abolition of stringent speed restrictions. With the ordinary double line flat junction the diamond crossing soon becomes a problem, as the flattest permissible angle for a fixed diamond crossing is 1 in 8, and this means that the maximum turnout radius is 22½ chains from a straight line, permitting a speed of 30 m.p.h.

An increased radius in the turnout can be obtained with a 1 in 8 diamond crossing by increasing the width of the 6-ft., but in the many sites where this cannot be done the alternative is to put in switch diamonds; in other words, replace each diamond crossing by two short switches. Switch diamonds are expensive, but when installed and well maintained, they improve the running considerably.

One of the great troubles in crossing work heretofore has been the impossibility of getting cant into the turnout between the switch and the crossing. On the L.M.S.R. designs are under trial whereby the thickness of the chair seat under the outside rails on the curves is increased, thus beginning the super-elevation at the heel of the switch instead of after the crossing. Experience of this practice so far is favourable.

Although high speed trains undoubtedly call for a higher standard of maintenance, any extra work in this respect has been more than offset by improvements in the design and materials used in the road. Alterations in maintenance practice, such as the introduction of mobile gangs, has not be due to the introduction of higher speeds, but to the urge for economy.

The necessity to maintain the top of the line to the highest possible standard for high speed running has led to experimenting with a method of maintenance practised in France and known as measured shovel packing. By this means unevenness in the level of the rails is made good by the insertion under the sleepers of a correctly measured quantity of fine ballast. Experimental lengths on the L.M.S.R. appear to indicate that road properly gone over by this means will retain its top about 50 per cent. longer than under normal conditions.

Should a considerable increase in the average speed of trains be made, there is no doubt that the increased size of locomotives would try the permanent way more highly than it does today, and it may well be that additional ballast will be required so that the greater weights may be distributed uniformly over the formation. The average sleeper spacing of 2 ft. 6 in. centre to centre, does not give a uniform distribution of load on the formation with, say, 9 in. of ballast, and it is a question for research as to whether it would be more economical to increase the depth of ballast or increase the number of sleepers. In many parts of British railways, owing to low overhead bridges and tight clearances, it would not be possible to add ballast and lift the road, as has been done to such a large extent in America and Germany, where there are few over-bridges.

By improvements in ballast and drainage the four group railways have undoubtedly made it possible to maintain the quality of running now standard. It would not have been possible with modern heavy rolling stock of high speeds to have had smooth and comfortable riding with the inferior type of ballast and the more primitive drainage common a number of years ago, and engineers generally find that the increase in the weight of engines is leading them year by year to extend the drainage of the formation both as a measure of economy and also to secure improved riding. Shovel or fly packing has largely superseded the old method of packing the ordinary ballast by a beater in this country and to a considerable extent in France, but in Germany and America the tendency is to adhere to the larger size of ballast, usually crushed to pass through a 2½ in. ring and packed under the sleepers by utilising power tampers, either pneumatic or electric. Satisfactory running road can be obtained either way, and it is difficult to decide which is the more economical to utilise in different circumstances.

There is no doubt that the American permanent way stood up very well physically to the great reduction in maintenance expenditure which was necessary during the depression, although the lag may have its reactions, but the whole structure of first class American track is much heavier than British, and it would be very costly to adopt it in this country, so that the mere fact that the Americans find their practice superior to ours does not mean that we should adopt their methods. In fact, the permanent way and haulage costs of the heavy rolling stock in America appear to be causing a movement there towards lighter rolling stock.

Greeting Cards, Calendars, and Diaries

On page 41 this week we refer editorially to the greetings we have received in the form of cards, calendars and diaries from the officers of railway and transport undertakings, and from commercial concerns, who are numbered among our readers and advertisers. The Christmas of 1935, and the New Year, have as usual inspired many productions of great artistic merit, and the following is the complete list of those to whom we tender our acknowledgments for greeting cards :—

Australian Commonwealth Railways Commissioner; Beckett, Laycock & Wilkinson Limited; European Manager, Canadian National Railways; Casa de Portugal; Compagnie Générale Transatlantique; *The Drapers' Record*; East Midland Traffic Commissioners; French State Railways; German Railways Information Bureau; General Manager, Superintendent of the Line, Chief Engineer, Chief Goods Manager, Commercial Assistant to the Chief Goods Manager, Goods Department, Stores Superintendent, Superintendent of Road Transport, Divisional Superintendent, Paddington, and Divisional Superintendent, Worcester, Great Western Railway; W. B. Gurney, Sons & Funnell; Imperial Airways Limited; Institute of Transport; General Manager, Iraq Government Railways; Japanese Ministry of Railways; Ing. Ernest Kaan; General Manager, Kenya & Uganda Railways; Lord Mayor, City, and County of Kingston-upon-Hull; Passenger Manager, District Passenger Manager, London, Advertising Manager, Information Agent, District Engineer, Stratford, Southern Area, and Signal and Telegraph Engineer, North Eastern Area, London & North Eastern Railway; Chief Operating Manager, London District Passenger Manager, Advertising and Publicity Officer, London Midland & Scottish Railway; Lt.-Col. J. P. S. Greig, R.E., Commandant, and the Officers, Railway Training Centre, Longmoor; *The Mutual Magazine*, Pennsylvania Railroad Employees; Commissioner and Executive Officers, New South Wales Government Railways; General Manager, Nigerian Railway; Port of Bristol Authority; General Superintendent, Dock Office, Preston; Queensland Railways Commissioner; Railway Air Services Limited; Messrs. Sandberg; General Manager, South African Railways and Harbours; *The South African Railways and Harbours Magazine*; Docks and Marine Manager, Southampton; Herr Frederic Strauss; General Manager, Sudan Railways; Superheater Co. Ltd.; and Swiss Federal Railways.

Calendars and Diaries

We acknowledge receipt of calendars and diaries from the following :—

Associated British Machine Tool Makers; Associated Equipment Co. Ltd.; J. H. Bunce & Co. Ltd.; British Insulated Cables Limited; British Timken Limited; Bruce Peebles & Co. Ltd.; Carter Paterson Limited; Craven Bros. (Manchester) Ltd.; Eversheds & Vignoles Limited; German State Railway; Grosvenor, Chater & Co. Ltd.; J. Halden & Co. Ltd.; Harland & Wolff Limited; Indian Railways Bureau; *Locomotion*; London Passenger Transport Board; Netherlands Railways; Nigerian Railway; Peckett & Sons Ltd.; Pennsylvania Railroad; Railway Passengers' Assurance Company; *Railway Review*; Thomas Robinson & Son Ltd.; Ruston-Bucyrus Limited; H. J. Ryman Limited; Taylor Bros. & Co. Ltd.; United Steel Companies Limited.

NOTES AND NEWS

Whitstable Station Name.—On and from February 1 next, Whitstable Town station, Southern Railway, will be renamed Whitstable & Tankerton.

Special Flower Trains. — The L.N.E. and L.M.S. Railways are running special trains to convey flowers grown at Spalding, Lincolnshire, to London, the Midlands, and the North.

Floods in France.—Owing to the serious and extensive flooding in France, railway communications have been seriously affected. The P.O.-Midi Bordeaux main line was cut by the flooding of Poitiers station, and traffic on the Nantes main line was also rendered impossible. Through trains had to be diverted, and local services abandoned.

Irish Railway Wages.—An agreement was signed at the close of 1935 between the Great Southern Railways Company and the three railway unions, which provides for the restoration as from January 1, 1936, of 2½ per cent. of the existing cut of 7½ per cent. in basic wages. The three unions had originally claimed the restoration of the full cut. For the present the 10 per cent. agreed cut in wages on the Northern Ireland and cross-border railways remains in operation.

Wage Cuts Restoration Claim.—A meeting was held in London on Tuesday, January 7, between the general managers of the four main-line railway companies and the representatives of the three railway trade unions in connection with the application made by the unions for discontinuance of the percentage deductions from earnings operating under the agreement of August 10, 1934, and variation of certain conditions of service, as determined by the National Wages Board decision No. 119 of March 5, 1931. After a full discussion of the position, it was agreed that the meeting should stand adjourned.

Road Accidents.—The Ministry of Transport return for the week ended January 4 of persons killed or injured in road accidents is as follows. The figures in brackets are those for the corresponding period of last year :—

	Killed, including deaths resulting from previous accidents	Injured
England ...	106 (131)	2,769 (3,277)
Wales	5 (4)	117 (135)
Scotland ...	14 (24)	267 (357)
	125 (159)	3,153 (3,769)

The total fatalities for the previous week were 145, as compared with 187 for the corresponding period of 1934.

Agreed Charges. — Seventy - two more applications for the approval of agreed charges have been lodged with the Railway Rates Tribunal, as will be seen from the legal notice published on page 81. A copy of each application (1s. post free) may be obtained from Mr. G. Cole Deacon, Secretary, Rates and Charges Committee, 35, Parliament Street, S.W.1. Notices of objection must be filed with the Registrar of the tribunal, Bush House, Aldwych, W.C.2, and a copy of each objection sent to Mr. Cole Deacon on or before January 28.

Another Named L.M.S.R. Train.—The L.M.S.R. announces that, commencing in May, the Thurso portion of the 6.30 a.m. train from Inverness, and the portion leaving Thurso at 3.40 p.m. in connection with the 3.35 p.m. from Wick, will be named The Orcadian.

New L.N.E.R. Halt at Garrowhill.—Work will be begun shortly on the building of a halt midway between Shettleston and Easterhouse stations to serve the extensive new housing scheme in the Garrowhill district. The halt, which will consist of two platforms, will have a weekday service of approximately 18 trains to and from Glasgow.

German Railway Freight Surcharge.—A 5 per cent. surcharge on goods traffic is being introduced by the German State Railway on January 20. There are certain important exceptions, chiefly foodstuffs, so as to avoid increasing the cost of living. The new rates are estimated to increase the Reichsbahn annual revenue by about RM. 100,000,000.

G.N.R. (Ireland) Goods Train Derailed.—Five wagons of the early morning goods train from Enniskillen to Derry were derailed at McKinney's Bridge, on the Northern Ireland-Free State border between Strabane and Porthall, on January 4, as a result of colliding with sixteen cattle. Traffic was held up for several hours owing to two of the wagons becoming wedged across the bridge, and the railway organised a bus and lorry service to carry traffic past the scene of the obstruction. It is thought that the cattle were being smuggled across the border.

The American Westinghouse Jubilee.—George Westinghouse, who died suddenly in New York on March 12, 1914, in his 68th year, is one of those individuals who has left a lasting memorial of himself and his work in the enterprises he inaugurated, and which continue to flourish under his name. On Wednesday of this week one of his great companies celebrated its jubilee, for it was on January 8, 1886, that the business now universally known as the Westinghouse Electric & Manufacturing Company was incorporated. It began operations in the following March in a small factory in Pittsburgh with a staff of 200. Today the various plants of the company number 19 ; in normal years it employs more than 40,000 persons ; and its annual sales amount to about $180,000,000. The U.S.A. plans to commemorate this fiftieth birthday included holding on the night of January 8, a " family " gathering in Pittsburgh, Pa., for the 12,000 employees in that district. Simultaneously a similar meeting of Westinghouse employees was arranged in every important Westinghouse factory and office in the country. A novel feature of this gathering of 40,000 employees was that the complete Pittsburgh programme was broadcast to all the other meetings over the Westinghouse company's own short wave transmitter. At Pittsburgh the meeting was addressed by the Chairman, Mr. A. W. Robertson, the President, Mr. F. A. Merrick, and others. Music was furnished by the Westinghouse Band, the Westinghouse Chorus, and the Westinghouse Kilty Band.

Preventing Staybolt Leakage.—In connection with the article on this subject on page 69 of the present issue, we understand that Dr. Ing. Tross, of Arno Holz-strasse 16, Berlin-Steglitz, Germany, is co-patentee with the Vereinigte Deutsche Metallwerke (manufacturers of Kuprodur) and Henschel & Sohn A.G. (manufacturers of the staybolts) in the constructional processes described, and that he is prepared to provide any further technical information required by our readers.

L.N.E.R. London City Manager's Staff Dinner.—A most enjoyable evening was spent on January 3 by 300 members of the staff of the London City Manager's district, L.N.E.R., at their fifth annual dinner and dance, held at the Liverpool Street Hotel under the chairmanship of Mr. Percy Syder, London City Manager. After the loyal toast had been honoured, the chairman proposed that of " The London & North Eastern Railway." In the course of his remarks Mr. Syder made reference to the achievements of the company during the past year. Mr. J. Bryson, Goods Agent, Bishopsgate, then proposed the toast of " The Chairman," to which Mr. Syder replied in characteristic manner.

Northern Ireland Road and Railway Transport.—The Road and Railway Transport (Redemption of Stock) Act (Northern Ireland), 1935, received the Royal Assent on December 17. It provides that Section 19 of the Road and Railway Transport Act (Northern Ireland), 1935 (which relates to the issue of transport stock), shall have effect as if for sub-section (8) thereof the following sub-section were substituted :—" (8) All or any part of the Northern Ireland Transport A stock and B stock may be redeemed at par at the option of the board upon or at any time after a date—(*a*) to be fixed by the board at the time of the issue of the stock concerned ; and (*b*) not being earlier than thirty years from the date of issue ; and all A stock shall be redeemed at par within a period not exceeding sixty years from the date of issue." The new Act is to be construed as one with the original Act, and the two Acts may together be cited as the Road and Railway Transport Act (Northern Ireland), 1935.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 1st Week			Totals to Date		
	1936	1935	Inc. or Dec.	1936	1935	Inc. or Dec.
L.M.S.R. (6,923 mls.)	£	£	£	£	£	£
Passenger-train traffic...	374,000	364,000	+ 10,000	374,000	364,000	+ 10,000
Merchandise, &c. ...	381,000	374,000	+ 7,000	381,000	374,000	+ 7,000
Coal and coke ...	258,000	220,000	+ 38,000	258,000	220,000	+ 38,000
Goods-train traffic ...	639,000	594,000	+ 45,000	639,000	594,000	+ 45,000
Total receipts	1,013,000	958,000	+ 55,000	1,013,000	958,000	+ 55,000
L.N.E.R. (6,336 mls.)						
Passenger-train traffic...	267,000	260,000	+ 7,000	267,000	260,000	+ 7,000
Merchandise, &c. ...	284,000	277,000	+ 7,000	284,000	277,000	+ 7,000
Coal and coke ...	219,000	203,000	+ 16,000	219,000	203,000	+ 16,000
Goods-train traffic ...	503,000	480,000	+ 23,000	503,000	480,000	+ 23,000
Total receipts	770,000	740,000	+ 30,000	770,000	740,000	+ 30,000
G.W.R. (3,750¼ mls.)						
Passenger-train traffic...	166,000	159,000	+ 7,000	166,000	159,000	+ 7,000
Merchandise, &c. ...	161,000	165,000	− 4,000	161,000	165,000	− 4,000
Coal and coke ...	115,000	101,000	+ 14,000	115,000	101,000	+ 14,000
Goods-train traffic ...	276,000	266,000	+ 10,000	276,000	266,000	+ 10,000
Total receipts	442,000	425,000	+ 17,000	442,000	425,000	+ 17,000
S.R. (2,154 mls.)						
Passenger-train traffic...	244,000	237,000	+ 7,000	244,000	237,000	+ 7,000
Merchandise, &c. ...	50,000	51,000	− 1,000	50,000	51,000	− 1,000
Coal and coke ...	35,000	31,000	+ 4,000	35,000	31,000	+ 4,000
Goods-train traffic ...	85,000	82,000	+ 3,000	85,000	82,000	+ 3,000
Total receipts	329,000	319,000	+ 10,000	329,000	319,000	+ 10,000
Liverpool Overhead ... (6¼ mls.)	1,179	1,094	+ 85	1,179	1,094	+ 85
Mersey (4½ mls.) ...	4,642	4,555	+ 87	4,642	4,555	+ 87
*London Passenger Transport Board ...	559,500	552,200	+ 7,300	14,705,600	14,494,200	+ 211,400
IRELAND						
Belfast & C.D. pass. (80 mls.)	2,136	2,209	− 73	2,136	2,209	− 73
,, ,, goods	486	581	− 95	486	581	− 95
,, ,, total	2,622	2,790	− 168	2,622	2,790	− 168
Great Northern pass. (543 mls.)	8,850	8,450	+ 400	8,850	8,450	+ 400
,, ,, goods	8,650	8,250	+ 400	8,650	8,250	+ 400
,, ,, total	17,500	16,700	+ 800	17,500	16,700	+ 800
Great Southern pass. (2,076 mls.)	20,356	20,236	+ 120	20,356	20,236	+ 120
,, ,, goods	37,961	37,734	+ 227	37,961	37,734	+ 227
,, ,, total	58,317	57,970	+ 347	58,317	57,970	+ 347

* 27th week, the receipts for which include those undertakings not absorbed by the L.P.T.B. in the corresponding period last year; last year's figures are, however, adjusted for comparative purposes

Indian 2-10-0 type Locomotive Fitted with A.C.F.I. Pattern Feed Water Heater

Among the economy measures that are being given thorough trials by the Indian State Railways, is the use of the feed water heater. On the North Western Railway the A.C.F.I. heater has been fitted to a standard 2-8-0 type H.G.S. (or Heavy Goods, Superheated) engine, and also to one of the interesting N class 2-10-0 locomotives, 29 of which were transferred from the Great Indian Peninsula system to the North Western when the main lines out of Bombay were electrified. Being oil-fired they came in handy for working the heavy main line traffic into and out of Karachi, as oil firing is standardised on the Karachi-Rohri section of the Karachi Division.

Though these engines were described in THE RAILWAY GAZETTE of January 14, 1921, they are of sufficient interest to warrant a few words of repeated description now, 15 years later. They were built about 1920 by the North British Locomotive Co. Ltd. of Glasgow and were designed for working 1,600-ton goods trains up long 1 in 150 grades. They have four simple-expansion cylinders each 20 in. × 26 in., the inside pair driving the second, and the outside pair driving the middle coupled wheels. Standard Walschaerts valve gear is used for the outside cylinders, but the inside ones are controlled by a system of rocking levers from the outside motion. Out of a total heating surface of all but 3,000 sq. ft., the superheater elements provide 824 sq. ft. and the firebox 230 sq. ft. Though the axle load is limited to 19 tons—actually 94½ tons are available for adhesion in working order—the tractive effort at 85 per cent. boiler pressure is about 50,000 lb. For their date of design, 1919, they are, therefore, very powerful. The engine now fitted with the A.C.F.I. feed heater is illustrated on page 69.

British and Irish Railways Stocks and Shares

Stocks	Highest 1935	Lowest 1935	Prices Jan. 8, 1936	Prices Rise Fall
G.W.R.				
Cons. Ord. ...	551/2	441/2	491/2	−1/2
5% Con. Prefce. ...	124	108	1191/2	+1
5% Red.Pref.(1950)	117	1063/4	1101/2	—
4% Deb.	1181/2	108	115	+3
4½% Deb. ...	122	110	1151/2	+2
4½% Deb. ...	1291/2	118	1251/2	+3
5% Deb.	1401/4	130	1351/2	+1
2½% Deb.... ...	821/4	681/2	74	+1
5% Rt. Charge ...	137	128	1331/2	—
5% Cons. Guar. ...	1363/4	1201/2	1331/2	+1
L.M.S.R.				
Ord.	255/16	16	171/2	−1/2
4% Prefce. (1923)	581/4	431/2	54	−1/2
4% Prefce. ...	871/2	731/2	83	—
5% Red.Pref.(1955)	107	973/4	1041/2	+1
4% Deb.	1101/4	991/2	1081/2	+1/2
5% Red.Deb.(1952)	11911/16	1115/16	1161/2	—
4% Guar.... ...	1055/8	951/2	1031/2	+1/2
L.N.E.R.				
5% Pref. Ord. ...	157/8	81/4	91/2	−1/2
Def. Ord.	7/16	3/4	5/16	−1/4
4% First Prefce....	743/4	48	561/2	−1/2
4% Second Prefce.	315/8	161/4	19	−1
5% Red.Pref.(1955)	921/4	71	791/2	—
4% First Guar. ...	10311/16	93	100	+1/2
4% Second Guar.	983/4	821/2	93	+1
3% Deb.	86	75	83	+1
4% Deb.	1091/4	981/2	1071/2	+1/2
5% Red.Deb.(1947)	1181/2	1061/2	1141/2	—
4½% Sinking Fund Red. Deb.	1121/2	108	110	+1
SOUTHERN				
Pref. Ord.... ...	871/2	695/8	83	—
Def. Ord. ...	2513/16	163/4	201/2	−1/2
5% Prefce. ...	124	1081/4	1201/2	+2
5% Red.Pref.(1964)	1173/4	1091/2	1141/2	—
5% Guar. Prefce.	1361/2	1211/2	1341/2	+1
5% Red.Guar.Pref. (1957)	1211/4	1121/2	1161/2	—
4% Deb.... ...	1163/4	107	115	+3
5% Deb.	138	1301/4	1351/2	+2
4% Red. Deb. 1962–67	115	1061/2	1131/2	+1
BELFAST & C.D.				
Ord.	9	4	9	—
FORTH BRIDGE				
4% Deb.	1111/4	1041/2	1031/2	—
4% Guar. ...	1097/8	104	1031/2	—
G. NORTHERN (IRELAND)				
Ord.	20	7	17	—
G. SOUTHERN (IRELAND)				
Ord.	571/2	141/2	393/4	−3/4
Prefce.	50	251/4	483/4	+1¾
Guar.	883/4	511/4	881/2	—
Deb.	861/4	70	871/2	+2¼
L.P.T.B.				
4½% "A" ...	130	1193/4	1241/2	+2
5% "A" ...	1393/4	130	1351/2	+1
4½% "T.F.A." ...	1135/4	108	1091/2	—
5% "B" ...	1311/2	1223/4	1281/2	+1
"C"	1031/2	91	110	+2
MERSEY				
Ord.	231/8	91/4	291/2	+7½
4% Perp. Deb. ...	1001/2	931/2	981/2	+1
3% Perp. Deb. ...	751/2	67	77	+1
3% Perp. Prefce.	62	471/4	651/2	+3

CONTRACTS AND TENDERS

Beyer, Peacock & Co. Ltd. has received an order from the San Paulo Railway for one metre-gauge Beyer-Garratt 2-6-0 + 0-6-2 articulated locomotive, for service on the Bragantina branch.

The Government of India, Railway Department (Railway Board), has placed orders for broad and metre gauge I.R.S. wagons under the 1936-7 requirements, as follow :—

Burn & Co. Ltd. : 72 BVG wagons for B-N., E.B., G.I.P. and N.W. Railways, and two MBVG wagons for E.B. Railway.

Jessop & Co. Ltd. : 10 BCR wagons for N.W. Railway.

Braithwaite & Co. Ltd. : 10 and 14 all-steel motor vans, respectively for M. & S.M. and S.I. Railways.

The Gloucester Railway Carriage & Wagon Co. Ltd. has received orders from the Crown Agents for the Colonies for two bogie parcels vans and 25 four-wheeled flat timber wagons, 4 ft. 8½ in. gauge, for the Palestine Railways.

Gleniffer Engines Limited has received an order for one eight-cylinder 160-b.h.p. diesel engine to be incorporated in a shunting locomotive to be built by Andrew Barclay & Co. Ltd. for the Air Ministry.

Hurst Nelson & Co. Ltd. has received an order from Charrington, Gardner, Locket & Co. Ltd. for 50 12-ton coke wagons.

Richardson & Cruddas Limited has received orders from the North Western Railway of India for 18 spans and 12 girders, each approx. 40 ft. for bridgework.

Hawthorn Leslie & Co. Ltd. has received an order from the Crown Agents for the Colonies for one locomotive boiler for a 0-6-2 tank locomotive, Mauritius Government Railways.

The South Indian Railway Administration has placed orders with P. & W. MacLellan Limited for 177 tons of steel bars and sections and with Guest, Keen & Nettlefolds Limited for 235½ tons of steel permanent way keys.

Alfred Herbert (India) Limited has received orders from the North Western Railway of India for one Kitchen & Wade high speed vertical drilling machine and three Lumsden No. 22 20 in. × 3½ in. double-ended floor grinders.

P. & W. MacLellan Limited has received an order from the Crown Agents for the Colonies for a quantity of deck spans for bridgework for the Nigerian Government Railway.

The Madras & Southern Mahratta Railway has placed orders to the inspection of Messrs. Rendel, Palmer & Tritton, as follow :—

Geo. Turton Platt Limited, 248 buffer plungers and spindles for carriage and wagon stock.

Wm. Beardmore & Co. Ltd., 593 locomotive tyres.

Premier Steel Tube Co. Ltd., 228 steel flue tubes and 3,420 steel boiler tubes.

The New Zealand Government Railways Administration has placed orders to the total value of £72,000 in this country for railway materials, divided among the following firms: British (Guest, Keen, Baldwins) Iron & Steel Co. Ltd. ; Barrow Haematite Steel Co. Ltd. ; Earl of Dudley's Round Oak Works Limited ; Guest, Keen & Nettlefolds Limited ; and Bayliss, Jones & Bayliss Limited.

L.M.S.R. Improvements at Scottish Hotel

Contracts have now been allotted by the L.M.S.R. for the extension of the Lochalsh Hotel at Kyle of Lochalsh, in the Western Highlands. The general contract has been placed with John Train, of Glasgow, and the following contracts have been placed for the detail work :

J. Baxter & Sons, Glasgow, Joinery. H. Twaddle & Sons, Glasgow, Plumbing. G. Rome & Co. (Glasgow) Ltd., Plastering. P. White & Co., Glasgow, Slating and roughcast. A. S. Wright & Co., Glasgow, Glazing. Chisholm & Co., Glasgow, Painting. H. Hope & Sons Ltd., Smethwick, Birmingham, Windows. Caxton Floors Ltd., London, S.W.1, Floors. Redpath Brown & Co., Trafford Park, Manchester, Steelwork.

Hurst Nelson & Co. Ltd. has received an order from the Egyptian State Railways Administration for 12 bogie passenger underframes, complete with wheels and axles, and to be fitted with Skefko roller bearing axleboxes.

The Bengal-Nagpur Railway Administration has placed the following orders : Yorkshire Engine Co. Ltd., 238 crank pins and two crank axles for locomotives ; Taylor Bros. Ltd., 250 disc wheels for wagons ; Steel, Peech & Tozer, 450 engine and tender tyres.

Accumulators of Woking (1928) Limited has received orders from the Bombay, Baroda & Central India Railway for 15,000 positive plates, 15,000 wood separators and other parts for train-lighting accumulators, to be supplied to the inspection of Messrs. Rendel, Palmer & Tritton.

The Bombay Baroda & Central India Railway is inquiring for tenders, receivable at The White Mansion, 91, Petty France, Westminster, S.W.1, by January 29, for steel material consisting of plates, angles, rounds, &c.

The Bengal-Nagpur Railway is inquiring for tenders, receivable at 132, Gresham House, Old Broad Street, London, E.C.2, by January 16, for 1,500 carriage and wagon tyres.

Bridgework Inquiry for Iran

The Kampsax Consortium is calling for tenders, to be presented in Tehran by February 12, for the supply and erection of five steel railway bridges. Firms desirous of offering bridgework of United Kingdom manufacture can obtain further details from the Department of Overseas Trade.

L.M.S.R. Central Division Annual Dinner.—For the fourth year in succession, the annual dinner of the office of the Divisional Superintendent of Operation was held at the County Hotel, Blackpool, on November 30, 1935. Mr. J. H. Robinson, the Divisional Superintendent, spoke appreciatively of the progress during 1935, and optimistically of 1936, which he considered would be even more strenuous. "The L.M.S. Railway" was proposed by Mr. R. O. Banister, Stationmaster, Preston, and Mr. Ashton Davies responded in a characteristic speech. The toast of "Our Visitors" was given by Mr. F. W. Abraham and acknowledged by Mr. S. H. Fisher, and by Mr. W. R. Jones. In responding to the toast of "The President," proposed by Messrs. J. Scragg and E. Townley, Mr. Robinson thanked all his staff for their efforts in the past, and asked for a further measure of that loyalty and support in the coming days. He also took the opportunity of expressing his keen appreciation of the services of Mr. Percy Turner, his recently-retired Assistant, and former Acting District Passenger Superintendent at Bolton.

Forthcoming Events

Jan. 11 (*Sat.*).—L.N.E.R. (Great Central) Lecture and Debating Society, at University College, Shakespeare Street, Nottingham, 4.30 p.m. "Summer Working at York Station," by Mr. C. Pattison.

Stephenson Locomotive Society (Midland & Northern Counties), at 4, Bury Old Road, Cheetham Hill, Manchester, 6.30 p.m. "Leicester and Swannington Railway," by Mr. P. Robinson.

Jan. 13 (*Mon.*).—Institute of Transport (London), at Inst. of Electrical Engineers, Savoy Place, W.C.2, 5.30 p.m. "Modern Methods of Permanent Way Maintenance," by Mr. J. Train.

Permanent Way Institution (London), at Euston Dining Club, L.M.S.R., Cardington Street, N.W.1, 7 p.m. "Permanent Way Drainage," by Mr. R. Coward.

Stephenson Locomotive Society (London), at Dining Club Room, King's Cross Station, L.N.E.R., 6.30 p.m. "Permanent Way: The Basis of Locomotive Running," by Mr. W. A. Willox.

Jan. 14 (*Tues.*).—Federation of N.E. Area Lecture and Debating Societies, at Temperance Inst., Darlington. "Train Speeds," by Mr. H. N. Gresley, C.B.E.

Institute of Transport (Birmingham), at Queen's Hotel, 6 p.m. "Road Transport," by Mr. O. Power.

Permanent Way Institution (Sheffield), at Royal Victoria Hotel, 7 p.m. "Another Picture of the Railway Future," by Mr. W. A. Willox.

Jan. 15 (*Wed.*).—Institute of Transport (Manchester-Liverpool Graduate), at Exchange Station Hotel, Liverpool, 6.45 p.m. "Passenger Railway Stock Operation," by Mr. W. Hargreaves.

Jan. 16 (*Thurs.*).—Institution of Electrical Engineers, Savoy Place, London, W.C.2, 6 p.m. "Recent Developments in Long Distance Telephony," by Mr. A. Timmis.

Permanent Way Institution (York), at Railway Inst., Queen Street, 6.30 p.m. "The Permanent Way from an Operating Point of View," by Mr. L. Ballan.

Railway Students' Association (Edinburgh), at Glasgow, Debate : "That the Unification of Land Transport in Great Britain Would be Detrimental to the Best Interests of the Public." Affirmative : Railway Students' Association. Negative : Glasgow Railway Lecture and Debating Society.

Jan. 17 (*Fri.*).—Institute of Transport (Leeds Graduate), at Leeds Transport Department, 7 p.m. "Rolling Stock," by Mr. F. Beebe.

LEGAL AND OFFICIAL NOTICES

In the Court of the Railway Rates Tribunal.

Road and Rail Traffic Act, 1933. Agreed Charges.

NOTICE IS HEREBY GIVEN that Applications for the approval of Agreed Charges under the provisions of Section 37 of the Road and Rail Traffic Act, 1933, short particulars of which are set out in the Schedule hereto, have been lodged with the Railway Rates Tribunal.

The said Applications may be inspected at the Office of the Tribunal, Bush House, Aldwych, London, W.C.2, at any time during office hours and at the following places:—

LONDON: Railway Clearing House, 123, Seymour Street, N.W.1.
BIRMINGHAM: District Goods Manager's Office, Snow Hill, Great Western Railway.
CARDIFF: Divisional Superintendent's Office, Great Western Railway.
EXETER: Western Divisional Superintendent's Office, Southern Railway.
LEEDS: District Goods Manager's Office, Wellington Street, London & North Eastern Railway.
LEICESTER: District Goods and Passenger Manager's Office, London Midland & Scottish Railway.
MANCHESTER: District Goods Manager's Office, Hunt's Bank, London Midland & Scottish Railway.
SOUTHAMPTON: Southern Divisional Superintendent's Office, Southampton West, Southern Railway.
YORK: Goods Manager's Office, London & North Eastern Railway.
ABERDEEN: District Goods and Passenger Manager's Office, London Midland & Scottish Railway.
EDINBURGH: District Goods and Passenger Manager's Office, Waverley Station, London & North Eastern Railway.
GLASGOW: Commercial Manager's Office, Central Station, London Midland & Scottish Railway.

A copy of each Application lodged with the Tribunal can be obtained from Mr. G. Cole Deacon, Secretary, Rates and Charges Committee, 35, Parliament Street, Westminster, London, S.W.1, price 1s., post free.

Notices of objection by any parties entitled to object to the approval of any of the said Agreed Charges must state concisely the grounds of objection and must be filed at the office of the Registrar, Bush House, Aldwych, London, W.C.2, on or before the 28th day of January, 1936, and a copy thereof on or before the same day served on or sent by registered post to Mr. G. Cole Deacon, at the above address. A separate Notice must be filed and served in respect of each Application.

Each Notice filed must be on foolscap size paper and must be stamped with an adhesive fee stamp for 2s. 6d. (which can be purchased at the office of the Tribunal only). If sent by post for filing each Notice must be accompanied by a Postal Order for 2s. 6d. payable to the Registrar when a stamp will be affixed at the office. A Notice by a Representative Body of Traders must contain a statement of the facts upon which such Body claims to represent a substantial number of traders interested in, or likely to be affected by the decision on, the application.

Five additional copies of each Notice must be lodged with the original at the office of the Registrar.

T. J. D. ATKINSON.
1st January, 1936. Registrar.

Number of Application and Date of Lodgment.	Parties to Agreement	Nature of Agreed Charge
1936. No. 1— Jan. 1, 1936	COLE & LEWIS, LTD., Cirencester, Glos., and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos. and L.P.T.B. *This Application, by leave granted under Rule 4, relates also to Agreed Charges with other Registered Bacon Curers in Great Britain as specified therein.*	Per Live Pig. Live Pigs consigned to Registered Bacon Curers or their Agents.
1936. No. 2— Jan. 1, 1936	CAVAGHAN & GRAY LIMITED, Haraby Factory, Carlisle, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos. and L.P.T.B. *This Application, by leave granted under Rule 4, relates also to Agreed Charges with other Registered Bacon Curers in Great Britain as specified therein.*	Per Live Pig. Live Pigs consigned to Registered Bacon Curers or their Agents.
1936. No. 3— Jan. 1, 1936	BRITISH PATENT PERFORATED PAPER CO. LTD., Atlas Works, Berkshire Road, Hackney Wick, London, E.9, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per ton. Toilet Paper, Paper Towels, Paper for Cash Tills or Time Recorders, not printed, and Empties returned to Suppliers.
1936. No. 4— Jan. 1, 1936	THE BRITON BRUSH CO. LTD., Wymondham, Norfolk, and the L. & N.E. Railway Co.	Per ton. Brushes; Bristles; Fibre; Feather Dusters; Hair, Mops; Scourers; Sponge Cloths; Wash Leathers; Broom and Brush Heads and Blocks, wooden without hair; Broom Handles; Advertising Material.
1936. No. 5— Jan. 1, 1936	GEO. T. COX & SONS LTD., 31, King William Street, London, E.C.4, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per ton. Groceries, Preserves and Provisions, such as those included in Exceptional Rates Lists G, H, S and T, as defined in the General Classification of Merchandise; Mixed Groceries; Disinfectants; Druggists' Sundries; Soap, Polishes and Cleansing Materials; Brooms and Brushes; Oilmen's Sundries; Stationery and Manufactured Tobacco and Cigarettes.
1936. No. 6— Jan. 1, 1936	A. C. FINCKEN & CO., 197, Gt. Portland Street, London, W.1, and the Cheshire Lines Committee and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per ton. "Force."
1936. No. 7— Jan. 1, 1936	A. C. FINCKEN & CO., 197, Gt. Portland Street, London, W.1, and the Cheshire Lines Committee and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per ton. Soap.
1936. No. 8— Jan. 1, 1936	THE FLEETWAY MANUFACTURING CO. LTD., Winton House, St. Andrew Street, London, E.C.4, and the G.W. and L.M. & S. Railway Cos.	Per ton. Domestic Woodware; Empties returned to Suppliers.
1936. No. 9— Jan. 1, 1936	HORLICK'S MALTED MILK CO. LTD., Slough, and the G.W. Railway Co.	Per ton. Malted Milk and Lemon Squash; Hardware; Glassware and Earthenware; and Advertising Matter.
1936. No. 10— Jan. 1, 1936	HYGIENE CORPORATION LIMITED, Konnomy Works, Bedford Avenue, Trading Estate, Slough, and the G.W. Railway Co.	Per ton. Scouring Powders.
1936. No. 11— Jan. 1, 1936	STARCH PRODUCTS LIMITED, Gludex Works, Mill Street, Slough, and the G.W. Railway Co.	Per ton. Glue and Dextrine.
1936. No. 12— Jan. 1, 1936	R. D. WADDELL LIMITED, Napiershall Street, Glasgow, N.W., and the L. & N.E. and L.M. & S. Railway Cos.	Per ton. Confectionery; Eggs; Groceries, Preserves and Provisions, such as those included in Exceptional Rates Lists G, H, S and T, as defined in the General Classification of Merchandise; Paper; Empties returned to Suppliers.
	Applicable also to traffic consigned by two Associated or Subsidiary Companies.	
1936. No. 13— Jan. 1, 1936	WESTERN MARGARINE LIMITED, Western Avenue, Acton, London, W.4, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per ton. Margarine, Lard and Lard Substitutes.
1936. No. 14— Jan. 1, 1936	JAMES AIKMAN & SONS, 43/53, Jeffrey Street, Edinburgh, and the L. & N.E. and L.M. & S. Railway Cos.	Per package. Boots and Shoes.
1936. No. 15— Jan. 1, 1936	MONTAGUE BURTON LIMITED, Hudson Road Mills, Leeds, 9, and the L. & N.E. and L.M. & S. Railway Cos.	Per package. Clothing.
1936. No. 16— Jan. 1, 1936	HIPPS (1931) LIMITED, Hipsley Works, Grace Street, Leeds, and the L. & N.E. and L.M. & S. Railway Cos.	Per package. Clothing.
1936. No. 17— Jan. 1, 1936	ALFRED E. JONES LIMITED, 32, 35 and 502, St. John's Market, Liverpool, and the Cheshire Lines Committee and the G.W., L. & N.E., and L.M. & S. Railway Cos.	Per ton. Meat (Cooked and Fresh), Meat Pies and Sausages.
1936. No. 18— Jan. 1, 1936	KIMBERLIN, BROWN & CO. LTD., "Kay Bee" House, Charles Street, Leicester, and the L. & N.E. and L.M. & S. Railway Cos.	Per package. Ladies' Outwear and Underwear, Gloves and Hosiery.
1936. No. 19— Jan. 1, 1936	POLIKOFF LIMITED, 31-51, Chatham Place, London, E.9, and the G.W., L. & N.E., L.M. & S., and Southern Railway Cos.	Per package. Clothing.
1936. No. 20— Jan. 1, 1936	JAS. SMITH & SONS (CLEANERS) LTD., The Dye Works, Dewsbury, and the G.W., L. & N.E., and L.M. & S. Railway Cos.	Per ton. (i) Dyed and Cleaned Goods. (ii) Goods for Dyeing and Cleaning. (iii) Returned Empties.
1936. No. 21— Jan. 1, 1936	SUNDERLAND & SONS LTD., 4, Darnley Street, Glasgow, and the L. & N.E. and L.M. & S. Railway Cos.	Per package. Clothing and Woollen Goods.
1936. No. 22— Jan. 1, 1936	R. D. WADDELL LIMITED, Napiershall Street, Glasgow, N.W., and the L. & N.E. and L.M. & S. Railway Cos.	Per ton. Bacon, Cooked Meat, Dripping, Hams, Lard, Meat and Fruit Puddings, Meat Pies, Preserved Provisions and Sausages.
	Applicable also to traffic consigned by two Associated or Subsidiary Companies.	
1936. No. 23— Jan. 1, 1936	GEO. E. WEEKS & CO., Swan Bakery, Oxford, and the G.W. and L.M. & S. Railway Cos.	Per ton. Cake, Pies and Confectionery.
1936. No. 24— Jan. 1, 1936	THE CENTRAL AGENCY LIMITED, 50, Bothwell Street, Glasgow, C.2, and the Cheshire Lines Committee and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per package. Thread, Needles, Silk Waste and Printed Matter.
1936. No. 25— Jan. 1, 1936	ACME WRINGERS LIMITED, David Street, Glasgow, S.E., and the L. & N.E. and L.M. & S. Railway Cos.	Per ton. Washing Machines, Wringing Machines and Iron or Steel Stands and Table Tops.

Legal and Official Notices—*continued*

Number of Application and Date of Lodgment	Parties to Agreement	Nature of Agreed Charge
1936. No. 26—Jan. 1, 1936	ALLIED SUPPLIERS LIMITED, 179-189, City Road, London, E.C.1, and the Southern Railway Co.	Per ton. Multiple Shop Traffic (Provisions, &c.).
1936. No. 27—Jan. 1, 1936	THE BRITISH OIL & CAKE MILLS LIMITED, Unilever House, Blackfriars, London, E.C.4, and the Southern Railway Co.	Per ton. Meals and Husks for Animal and Poultry Feeding; Poultry Food, solid.
1936. No. 28—Jan. 1, 1936	THE CARBORUNDUM CO. LTD., Trafford Park, Manchester, and the Cheshire Lines Committee and the G.W., L. & N.E. and L.M. & S. Railway Cos.	Per ton. Emery Wheels, Scythe Stones and Abrasives.
1936. No. 29—Jan. 1, 1936	WM. COLLINS, SONS & CO. LTD., 144, Cathedral Street, Glasgow, C.4, and the L. & N.E. and L.M. & S. Railway Cos.	Per ton. Books, Magazines, Papers, daily and weekly, Periodicals, Stationery.
	Applicable also to traffic consigned by any Associated or Subsidiary Company.	
1936. No. 30—Jan. 1, 1936	THE DISTRIBUTERS & TRANSPORTERS LIMITED (MESSRS. UNILEVERS DISTRIBUTING ORGANISATION), Unilever House, Blackfriars, London, E.C.4, and the Southern Railway Co. *Applicable to traffic consigned by 36 Associated or Subsidiary Companies.*	Per ton. Soap, Soap with articles for advertisement, Margarine, Lard and Lard Substitutes.
1936. No. 31—Jan. 1, 1936	THE DISTRIBUTERS & TRANSPORTERS LIMITED (MESSRS. UNILEVERS DISTRIBUTING ORGANISATION), Unilever House, Blackfriars, London, E.C.4, and the Southern Railway Co. *Applicable to traffic consigned by two Associated or Subsidiary Companies.*	Per ton. Soap and Soap with articles for advertisement.
1936. No. 32—Jan. 1, 1936	THE DISTRIBUTERS & TRANSPORTERS LIMITED (MESSRS. UNILEVERS DISTRIBUTING ORGANISATION), Unilever House, Blackfriars, London, E.C.4, and the G.W., and L.M. & S. Railway Cos. *Applicable to traffic consigned by five Associated or Subsidiary Companies.*	Per ton. Candles, Soap and Soap with articles for advertisement.
1936. No. 33—Jan. 1, 1936	THE HALLAMSHIRE VINEGAR CO. LTD., Fairfield Road, Neepsend, Sheffield, and the L. & N.E. and L.M. & S. Railway Cos.	Per ton. Vinegar, Pickles and Sauces.
1936. No. 34—Jan. 1, 1936	THE HALLAMSHIRE VINEGAR CO. LTD., Fairfield Road, Neepsend, Sheffield, and the Cheshire Lines Committee and the G.W., L. & N.E., and L.M. & S. Railway Cos. and L.P.T.B. and the Midland and Great Northern Joint Committee	Per ton. Empties returned to the Trader.
1936. No. 35—Jan. 1, 1936	HUGON & CO. LTD., Ogden Lane, Openshaw, Manchester, and the Cheshire Lines Committee and the G.W., L. & N.E. and L.M. & S. Railway Cos.	Per package. Suet, Lard, Tinned Fruits, Tinned and Packet Peas and Beans, Paper Bags and Printed Matter, unbound.
1936. No. 36—Jan. 1, 1936	ALBERT E. JONES (LONGDON) LIMITED, Pallsy Pottery, Longton, Stoke-on-Trent, and the L.M. & S. Railway Co.	Per package. China and Earthenware.
1936. No. 37—Jan. 1, 1936	NESTLE'S MILK PRODUCTS LIMITED, 6 & 8, Eastcheap, E.C.3, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per ton. Chocolate; Cocoa; Confectionery, dummy samples, utility and novelty packages and "Gift Scheme" articles.
1936. No. 38—Jan. 1, 1936	JOHN PATERSON & CO. LTD., Clensel Works, Orr Street, Glasgow, and the L. & N.E., and L.M. & S. Railway Cos.	Per ton. Ammoniated Liquid Soap and Ammonia Solution in bottle packed in cases.
1936. No. 39—Jan. 1, 1936	JOHN PATERSON & CO. LTD., Clensel Works, Orr Street, Glasgow, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos. and L.P.T.B.	Per ton. Empties returned to the Trader.
1936. No. 40—Jan. 1, 1936	SPILLERS LIMITED, 40, St. Mary Axe, London, E.C.3, and the Southern Railway Co.	Per ton. Dog Biscuits, Bird Seed, Poultry Foods and Advertising Material.
1936. No. 41—Jan. 1, 1936	SPILLERS LIMITED, 40, St. Mary Axe, London, E.C.3, and the G.W. and L.M. & S. Railway Cos.	Per ton. Dog Biscuits and Bird Seed; Hound Meal in less lots than 2 tons.
1936. No. 42—Jan. 1, 1936	JOHN WALLACE & CO. LTD., Rowallan Creamery, Kilmarnock, and the L.M. & S. Railway Co.	Per package. Butter.
	Applicable also to traffic consigned by one Associated or Subsidiary Company.	
1936. No. 43—Jan. 1, 1936	ANGUS WATSON & CO. LTD., Southall, Middlesex, and the G.W. Railway Co.	Per ton. Groceries, Preserves and Provisions, such as those included in Exceptional Rates Lists G, H, S and T, as defined in the General Classification of Merchandise; Stationery, Show Cards and Gifts for advertisement.
1936. No. 44—Jan. 1, 1936	ANGUS WATSON & CO. LTD., Southall, Middlesex, and the G.W. Railway Co.	Per ton. Groceries, Preserves and Provisions, such as those included in Exceptional Rates Lists G, H, S and T, as defined in the General Classification of Merchandise, Stationery, Show Cards and Gifts for advertisement.
	Applicable to traffic consigned by two Associated or Subsidiary Companies.	
1936. No. 45—Jan. 1, 1936	WIGGINS, TEAPE & ALEX. PIRIE (SALES) LIMITED, 16-58, Mansell Street, Aldgate, London, E.1, and the L. & N.E. Railway Co.	Per ton. Paper, in bales, bundles and rolls for printing, and Paper in cases.
1936. No. 46—Jan. 1, 1936	CLIFFORD WILLIAMS & SON LTD., Anne Road, Handsworth, Birmingham, 21, and the G.W. and L.M. & S. Railway Cos.	Per ton. Clothing; Empties returned to Suppliers.
1936. No. 47—Jan. 1, 1936	ACHILLE SERRE LIMITED, Blackhorse Lane, Walthamstow, London, E.17, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per package. (i) Dyed and Cleaned Goods, also Advertising Material used in connection with the Trader's business. (ii) Goods for Dyeing and Cleaning.
	Applicable also to traffic consigned by two Associated or Subsidiary Companies.	
1936. No. 48—Jan. 1, 1936	APLIN & BARRETT LIMITED, Yeovil, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per ton. Butter, Cheese, Cream, Eggs, Sausages, Meat Pies, Cooked Meats, Preserved Meat, Preserved Fish, Condensed Milk, Dyelcon (Meat and Vegetable Extract), Honey, Christmas Puddings, Show Cards (unframed), Printed Advertising Matter and Stationery.
	Applicable also to traffic consigned by one Associated or Subsidiary Company.	
1936. No. 49—Jan. 1, 1936	J. H. BOUNDS, 4, Whitworth Street, Manchester, and the Cheshire Lines Committee and the G.W., L. & N.E. and L.M. & S. Railway Cos.	Per package. Manufactured Cotton, Linen and Woollen Goods.
1936. No. 50—Jan. 1, 1936	BRITISH STEAM SPECIALITIES LIMITED, Fleet Street, Leicester, and the L. & N.E. and L.M. & S. Railway Cos.	Per package. Machinery Parts, such as Valves, Gauges, Pumps and Lubricators, also Fittings and Tools.
1936. No. 51—Jan. 1, 1936	B.S.A. CYCLES LIMITED, Birmingham, and the G.W. and L.M. & S. Railway Cos.	Per Motor Bicycle. Motor Bicycles (complete).
1936. No. 52—Jan. 1, 1936	S. COLLIER & CO. LTD., Trowbridge, and the G.W. Railway Co.	Per package. Cloth.
1936. No. 53—Jan. 1, 1936	WM. COLLINS, SONS & CO. LTD., 144, Cathedral Street, Glasgow, C.4, and the L. & N.E. and L.M. & S. Railway Cos.	Per package. Books and Stationery.
1936. No. 54—Jan. 1, 1936	DOMINION DAIRY CO. LTD., Aylesbury, Bucks, and the L.M. & S. Railway Co., and the L.P.T.B. (MET. SECTION) and G.C.Jt. and G.W. and G.C.Jt. Railway Cos.	Per ton. Butter and Cheese.
1936. No. 55—Jan. 1, 1936	DRYAD LIMITED, 42, St. Nicholas Street, Leicester, and the L. & N.E. and L.M. & S. Railway Cos.	Per package. Cane Work, Plywood, Rush Work, Raffia, Cardboard Shapes, Wool Brushes and Tools for Handicraft work.
1936. No. 56—Jan. 1, 1936	EMPIRE STORES LIMITED, Canal Road, Bradford, and the L. & N.E. and L.M. & S. Railway Cos.	Per package. Clothing, Drapery and General Stores Wares.
1936. No. 57—Jan. 1, 1936	FARMA CREAM PRODUCT CO. LTD., 23-25, Prince of Wales Crescent, London, N.W.1, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per package. Butter, Farma Cream, Fresh Cream, Milk Powder and Condensed Milk.
1936. No. 58—Jan. 1, 1936	THOS. FATTORINI (SKIPTON) LIMITED, 1-7, Newmarket Street, Skipton, Yorkshire, and the L.M. & S. Railway Co.	Per package. Clothing, Drapery and General Stores Wares.
1936. No. 59—Jan. 1, 1936	GRATTAN WAREHOUSES LIMITED, Bradford (Yorks), and the L. & N.E. and L.M. & S. Railway Cos.	Per package. Clothing, Drapery and General Stores Wares.
1936. No. 60—Jan. 1, 1936	W. A. HOGG LIMITED, 19, Queen Street, Leeds, and the L. & N.E. and L.M. & S. Railway Cos.	Per package. Clothing and Woollen Goods.

Legal and Official Notices—*continued*

Number of Application and Date of Lodgment	Parties to Agreement	Nature of Agreed Charge
1936. No. 61—Jan. 1, 1936	JOHN MYERS & CO. LTD., Westminster Bridge Road, London, S.E., and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per package.
1936. No. 62—Jan. 1, 1936	H. PEARSON LIMITED, Old Trafford, Manchester, and the L. & N.E. and L.M. & S. Railway Cos.	Clothing, Drapery and General Stores Wares.
1936. No. 63—Jan. 1, 1936	S. SIMPSON LIMITED, 92-100, Stoke Newington Road, London, N.16, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per package.
1936. No. 64—Jan. 1, 1936	"TWO STEEPLES" LIMITED, Wigston, and the L.M. & S. Railway Co.	Clothing, Drapery and Cloth Patterns.
1936. No. 65—Jan. 1, 1936	J. E. YORK LIMITED, 79, Fortess Road, London, N.W.5, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per package.
1936. No. 66—Jan. 1, 1936	CARRERAS LIMITED, Arcadia Works, Hampstead Road, London, N.W.1, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Woollen Goods.
1936. No. 67—Jan. 1, 1936	J. A. SHARWOOD & CO. LTD., Offley Works, Offley Road, London, S.W.9, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per package.
		Clothing, Drapery and General Stores Wares.
		Per ton.
		Manufactured Tobacco and Cigarettes, also Advertising Matter.
		Per ton.
		Preserves, Cherries in Brine, Groceries, Almonds, Confectionery, Essences (Flavouring), Fancy Goods, Fruit Syrups Gelatine, Olive Oil, Advertising Matter and Empties returned to Suppliers.
1936. No. 68—Jan. 1, 1936	CO-OPERATIVE WHOLESALE SOCIETY LIMITED, 1, Balloon Street, Manchester, and the L. & N.E. and L.M. & S. Railway Cos.	Per package.
1936. No. 69—Jan. 1, 1936	FULLERS LIMITED, Hammersmith, London, W.6, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Shirts.
		Per package.
		Cakes and Confectionery, also small parcels of packing material and equipment sent to Trader's Branches.
1936. No. 70—Jan. 1, 1936	GREENGATE & IRWELL RUBBER CO. LTD., Greengate Works, Manchester, and the Cheshire Lines Committee, and the G.W., L. & N.E. and L.M. & S. Railway Cos.	Per package.
		Waterproof and Showerproof Coats; Light Electric Cable; Rubber Boots and Shoes; Belting—Balata, Rubber, Canvas and Rubber; Rubber Goods; Gaiters, Leggings and Slippers (Felt and or Leather); Ebonite Sheets and Cylinders.
1936. No. 71—Jan. 1, 1936	S. A. SQUIRRELL & CO., Colton Street, Leicester, and the L. & N.E. and L.M. & S. Railway Cos.	Per package.
1936. No. 72—Jan. 1, 1936	SAMUEL DRIVER LIMITED, Barton Road, Dewsbury Road, Leeds, and the L. & N.E. and L.M. & S. Railway Cos.	Boots and Shoes.
		Per package.
		Clothing, Drapery and General Stores Wares.

South Indian Railway Company Limited.

THE Directors are prepared to receive Tenders for the supply of:—

1. COPPER INGOTS.
2. HELICAL AND VOLUTE SPRINGS.

Specifications and Forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W.1.

Tenders addressed to the Chairman and Directors of the South Indian Railway Company Limited, marked "Tender for Copper Ingots" or as the case may be, with the name of the firm tendering, must be left with the undersigned not later than 10 a.m. on Friday, the 17th January, 1936, in respect of Specification No. 1, and not later than 12 Noon on Friday, the 24th January, 1936, in respect of Specification No. 2.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 10s. for each copy of each Specification.

Copies of the drawings may be obtained at the Offices of the Company's Consulting Engineers, Messrs. Robert White & Partners, 3, Victoria Street, London, S.W.1.

E. A. S. BELL,
Managing Director.

91, Petty France,
Westminster, S.W.1.
8th January, 1936.

PATENTS for Inventions, Trade Marks. Advice, Handbook, and consultations free. King's Patent Agency, Ltd. (B. T. King, C.I.M.E., Registered Patent Agent, G.B., U.S., and Canada), 146A, Queen Victoria Street, London, E.C.4. 49 years' references. 'Phone City 6161.

Bengal-Nagpur Railway Company Limited

THE Directors are prepared to receive Tenders for:—

1,530 STEEL CARRIAGE AND WAGON TYRES.

Specification and Form of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad Street, London, E.C.2, on or after Monday, 6th January, 1936.

A fee of 20s. will be charged for each copy of the Specification, which is NOT returnable.

Tenders must be submitted not later than Noon on Thursday, 16th January, 1936.

The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right of reducing or dividing the order.

By Order of the Board,
T. R. WYNNE,
Managing Director.

Crown Agents for the Colonies

COLONIAL GOVERNMENT APPOINTMENTS

APPLICATIONS from qualified candidates are invited for the following post:—

ASSISTANT ENGINEER required by the Government of Nigeria for the Railway Department for two tours of twelve to eighteen months. Salary £540–£30–£720 a year. Free passages and quarters and liberal leave on full salary. Candidates, aged 25 to 35, must be Corporate Members of the Institution of Civil Engineers and be experienced in bridge and reinforced concrete construction.

Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, and mentioning this paper, to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting M/4051.

Kenya and Uganda Railways and Harbours.

SALE OF LOCOMOTIVES.

TENDERS are invited for the purchase of 37 Locomotives, either as complete locomotives, or to be broken up as scrap. The locomotives are of the 4-8-0 type, metre gauge, with tenders; weight approximately 55 tons. Copper fireboxes and firebox stays.

Drawings may be seen and full particulars, including conditions of sale, may be obtained from the Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

Tenders due Nairobi 31st March, 1936.

AN Assistant Electrical Engineer is required by the London & North Eastern Railway in connection with Electric Traction Extensions; experience with 1,500-Volt D.C. Overhead Line Equipment essential. Salary £1,500 per annum. Applications, giving particulars of experience, to be sent to the Chief Mechanical Engineer, King's Cross Station, London, N.1.

OFFICIAL ADVERTISEMENTS.

OFFICIAL ADVERTISEMENTS intended for insertion on this page should be sent in as early in the week as possible. The latest time for receiving official advertisements for this page for the current week's issue is noon on Thursday. All advertisements should be addressed to:—*The Railway Gazette*, 33, Tothill Street, Westminster, London, S.W.1.

RAILWAY AND OTHER REPORTS

Paraguay Central Railway.—In submitting accounts for the year ended June 30, 1935, the directors have adopted the average market rate for the year in converting revenue items into sterling. On this basis gross receipts were £62,418, and working expenses £45,612, leaving net receipts of £16,806. Adding interest and other receipts gives a total of £27,829. Loss in exchange amounted to £32,585, with the result of a deficit for the year of £4,757. Interest on the 6 per cent. prior lien debenture stock and on the 7 per cent. A debenture stock, together amounting to £53,500, has not been paid, and the total debit balance carried forward is now £108,216. Revisions of tariffs have been made during the year which have helped to increase receipts in Paraguayan currency, but not enough to offset the heavy exchange losses and the increases granted in salaries and wages to meet higher cost of living. Following upon the signing, on June 12, 1935, of an armistice between Paraguay and Bolivia, a peace conference is sitting in Buenos Aires.

Midland Bank Limited.—The directors report that net profits for 1935 amount to £2,353,098 which, with £871,946 brought forward, makes £3,225,044, out of which the following appropriations amounting to £1,653,376 have been made: To interim dividend, paid July 15, 1935, for the half-year ended June 30, 1935, at the rate of 16 per cent. per annum, less income tax, £883,376; to reduction of bank premises account, £300,000; to reserve for future contingencies, £250,000; to centenary bonus to the staff and pensioners of 5 per cent., £200,000; to bank clerks' orphanage, £20,000; leaving a sum of £1,571,668 from which the directors recommend (*a*) a dividend, payable February 1 next, for the half-year ended December 31, 1935, at the rate of 16 per cent. per annum less income tax, £883,376; (*b*) a centenary bonus, payable with the dividend on February 1 next, at the rate of 2 per cent. on the paid up capital of the company, less income tax, £220,844; and a balance to be carried forward of £467,447.

Railway Share Market

Notwithstanding that generally favourable conditions ruled in the stock and share markets during the week the dispute in the coalfields has exercised a crippling effect on business in home railway stocks. In addition, the reopening of conversations regarding restoration of the balance of the wages cuts of the railwaymen has not been helpful. It is argued in the market that the net revenues of the companies do not justify any further restoration without further prejudicing the resumption of dividends on the senior preference stocks of the companies.

Some of these preference stocks are trustee securities, notably the Great Western and the Southern issues, and the margin covering their payment is still very narrow. The traffic receipts announced on Wednesday were satisfactory, having in mind the bad traffic conditions due to the weather. The returns could not counterbalance the general depression which existed in the home railway market. Discussion as to dividend prospects next month, which is usually frequent at this time of the year, is entirely absent as it is realised the whole position may be so changed as to affect the directorial dividend policy when the meetings are called to discuss the matter in February. Although nearly all the junior stocks have sustained a fall in price there has been an improvement in debenture stocks. It was reported that some exchanges were being made out of the junior stocks into the prior charge securities. London Passenger Transport Board's "C" stock was again bought as a result of attention being called to the attractive character of the stock by brokerage firms in their New Year investment reviews.

Mersey ordinary had an advance on talk of the company being included in Liverpool Transport Board. In foreign railroad stocks the chief movement was in American railway shares which had a sharp fall in price following the Supreme Court's decision. Union Pacific, Illinois Central, and Southern were weak spots. Argentine stocks weakened on the riots in Buenos Aires which it was assumed would reduce the week's traffic receipts. Among Brazilians, Leopoldina issues were active on hopes of Government concessions.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1935-36	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1935	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1935	Prices: Lowest 1935	Prices: Jan. 8, 1936	Yields% (See Note)
South & Central America.	Antofagasta (Chili) & Bolivia	830	5.1.36	£ 9,100	– £ 2,900	1	£ 4,920	£ 7,400	– £ 2,480	Ord. Stk.	23	14 15/16	21	Nil
	Argentine North Eastern	753	4.1.36	6,393	– 788	27	217,086	200,152	+ 16,934	,,	7	4	6	Nil
	Argentine Transandine	—	—	—	— —	—	—	—	—	A. Deb.	49 1/2	30	46	8 11/16
	Bolivar	174	Dec., 1935	4,700	– 1,000	52	71,300	71,400	– 100	6 p.c. Deb.	13	5	10	Nil
	Brazil	—	—	—	— —	—	—	—	—	Bonds.	14	11	13	3 15/16
	Buenos Ayres & Pacific	2,806	4.1.36	84,078	+ 20,303	27	2,030,008	1,853,668	+ 176,340	Ord. Stk.	101 1/2	47/8	8	Nil
	Buenos Ayres Central	190	21.12.35	$101,300	+ $2,800	25	$3,034,000	$3,030,800	+ $3,200	Mt. Deb.	21	10	13	Nil
	Buenos Ayres Gt. Southern	5,085	4.1.36	133,666	– 23,544	27	3,251,372	3,326,690	– 76,318	Ord. Stk.	27	13 1/2	18	Nil
	Buenos Ayres Western	1,930	4.1.36	45,515	+ 5,676	27	1,117,130	1,122,632	– 5,502	,,	24	10	14 1/2	Nil
	Central Argentine	3,700	4.1.36	129,166	+ 16,411	27	3,171,549	3,093,458	+ 78,091	,,	17 7/8	7	11 1/2	Nil
	Do.	—	—	—	— —	—	—	—	—	Dfd.	9	3 1/4	5 1/2	Nil
	Cent. Uruguay of M. Video	273	23.12.35	12,003	– 1,628	26	263,809	413,262	– 149,453	Ord. Stk.	8 1/2	3	5	Nil
	Do. Eastern Extn.	311	28.12.35	2,163	+ 143	26	43,659	46,778	– 3,119	—	—	—	—	—
	Do. Northern Extn.	185	28.12.35	1,517	+ 257	26	31,433	25,447	+ 5,986	—	—	—	—	—
	Do. Western Extn.	211	28.12.35	755	– 113	26	20,167	19,724	+ 443	—	—	—	—	—
	Cordoba Central	1,218	4.1.36	23,560	– 2,640	27	806,710	802,820	+ 3,890	Ord. Inc.	4	1	2	Nil
	Costa Rica	188	Oct., 1935	11,634	– 2,012	17	55,349	63,485	– 8,136	Stk.	35	30	34	5 7/8
	Dorada	70	Nov., 1935	13,300	+ 2,900	48	130,700	112,800	+ 17,900	1 Mt. Db.	103 5/8	102 1/2	102 1/2	5 7/8
	Entre Rios	810	4.1.36	10,165	– 6,757	27	308,181	328,675	– 20,486	Ord. Stk.	15	6 1/2	10	Nil
	Great Western of Brazil	1,082	4.1.36	8,700	+ 1,000	1	4,600	6,600	– 2,000	Ord. Sh.	1/2	3/16	1/2	Nil
	International of Cl. Amer.	794	Nov., 1935	$414,982	+ $49,120	48	$4,259,092	$4,311,914	– $52,822	—	—	—	—	—
	Interoceanic of Mexico	—	—	—	— —	—	—	—	—	1st Pref.	1/2	5/32	1/2	Nil
	La Guaira & Caracas	22 3/4	Dec., 1935	4,200	+ 1,000	52	45,345	42,350	+ 2,995	Stk.	8 1/2	8	8 1/2	Nil
	Leopoldina	1,918	4.1.36	21,571	+ 1,962	1	10,758	12,737	– 1,979	Ord. Stk.	8 1/2	2 1/2	9 1/2	Nil
	Mexican	483	31.12.35	$347,300	+ $43,100	26	$6,560,100	$5,924,500	+ $635,600	,,	1 1/2	1/4	5/4	Nil
	Midland of Uruguay	319	Nov., 1935	8,356	– 5,180	22	30,701	52,325	– 21,624	,,	1 1/2	1 1/2	1 1/2	Nil
	Nitrate	401	31.12.35	8,685	+ 2,130	52	155,267	135,619	+ 19,648	Ord. Sh.	64/-	42/-	2 8	Nil
	Paraguay Central	274	4.1.36	$2,185,000	+ $1,180,000	27	$55,821,000	$26,840,000	+ $28,981,000	Pr. Li. Stk.	80 1/2	60	76 1/2§	7 15/16
	Peruvian Corporation	1,059	Dec., 1935	78,507	+ 16,529	26	454,297	371,516	+ 82,781	Pref.	10 5/8	6 7/16	10	Nil
	Salvador	100	28.12.35	¢28,500	—	26	¢357,996	¢331,552	+ ¢26,444	Pr. Li.Db.	65	61	65	7 11/16
	San Paulo	153 1/2	29.12.35	19,802	– 7,558	52	1,307,002	1,418,736	– 111,734	Ord. Stk.	80	35	52	4 15/16
	Taltal	164	Nov., 1935	4,005	+ 1,780	22	16,645	11,430	+ 5,215	Ord. Sh.	1 11/16	1 1/8	1 5/8	7 1/4
	United of Havana	1,353	4.1.36	14,926	+ 2,410	27	415,138	434,143	– 19,005	Ord. Stk.	3 1/16	1	2	Nil
	Uruguay Northern	73	Nov., 1935	1,106	– 216	22	3,633	5,766	– 2,133	Deb. Stk.	4 1/2	2 15/16	4 1/2	Nil
Canada.	Canadian National	23,684	31.12.35	844,476	+ 79,553	52	34,553,627	32,868,807	+ 1,684,820	—	—	—	—	—
	Canadian Northern	—	—	—	— —	—	—	—	— 4 p.c.	Perp. Dbs.	78 5/8	52 1/2	65 1/2	6 1/8
	Grand Trunk	—	—	—	— —	—	—	—	—	4 p.c. Gar.	103 5/8	93	99 1/2	4
	Canadian Pacific	17,224	31.12.35	690,400	+ 57,800	52	25,935,800	25,108,600	+ 827,200	Ord. Stk.	14 1/16	8 5/4	11	Nil
India.†	Assam Bengal	1,329	10.12.35	33,660	– 6,162	36	856,014	982,345	– 126,331	Ord. Stk.	92 1/8	77 1/2	82 1/2	3 5/8
	Barsi Light	202	10.12.35	3,322	+ 45	36	96,847	99,997	– 3,150	Ord. Sh.	105	77 1/2	78 1/2	6 3/8
	Bengal & North Western	2,112	20.12.35	71,056	– 6,829	38	545,359	543,154	+ 2,205	Ord. Stk.	301 1/2	291	293 1/2	5 7/16
	Bengal Dooars & Extension	161	10.12.35	4,188	– 346	36	98,841	110,332	– 11,491	,,	127 1/2	122	123 1/2	5 11/16
	Bengal-Nagpur	3,268	30.11.35	178,875	+ 8,849	34	4,202,711	3,848,353	+ 354,358	,,	105	100 5/16	101 1/2	3 15/16
	Bombay, Baroda & Cl. India	3,072	31.12.35	256,200	– 23,475	39	5,954,025	5,973,900	– 19,875	,,	115 1/4	110	110 1/2	5 7/16
	Madras & Southern Mahratta	3,230	10.12.35	126,900	– 3,795	36	3,620,557	3,881,348	– 260,791	,,	128 1/2	113 7/8	115 1/2	7 1/4
	Rohilkund & Kumaon	572	20.12.35	13,679	– 1,590	38	96,144	100,560	– 4,416	,,	294	262	287 1/2	5 9/16
	South India	2,526	10.12.35	99,944	– 3,510	36	2,743,178	2,887,981	– 144,803	,,	119 5/4	104 1/4	105 1/2	7 1/8
Various.	Beira-Umtali	204	Oct., 1935	65,747	+ 4,612	4	65,747	61,135	+ 4,612	—	—	—	—	—
	Bilbao River & Cantabrian	15	Dec., 1935	1,516	– 98	52	18,469	19,947	– 1,478	—	—	—	—	—
	Egyptian Delta	622	20.12.35	7,946	+ 634	38	181,429	173,077	+ 8,352	Prf. Sh.	2	1 5/8	1 5/4	5 11/16
	Great Southern of Spain	104	28.12.35	1,828	– 926	52	93,304	118,072	– 24,772	Inc. Deb.	3 1/2	2	3 1/2	Nil
	Kenya & Uganda	1,625	Nov., 1935	182,196	+ 11,855	48	2,184,339	2,030,213	+ 154,126	—	—	—	—	—
	Manila	—	—	—	— —	—	—	—	—	B. Deb.	48	36	38	9 5/16
	Mashonaland	913	Oct., 1935	111,983	– 5,290	4	111,983	117,273	– 5,290	1 Mg. Db.	104 1/4	100	102	4 7/8
	Midland of W. Australia	277	Nov., 1935	14,519	– 556	22	68,781	71,429	– 2,648	Inc. Deb.	98 5/4	93	92 1/2	5 8
	Nigerian	1,905	23.11.35	61,451	– 15,247	34	1,000,335	1,089,212	– 88,877	—	—	—	—	—
	Rhodesia	1,538	Oct., 1935	202,694	+ 13,135	4	202,694	189,559	+ 13,135	4 p.c. Db.	105 1/2	101	104	3 7/8
	South African	13,246	14.12.35	667,849	+ 84,374	37	20,989,783	18,943,473	+ 2,046,310	—	—	—	—	—
	Victoria	4,728	Sept., 1935	789,330	+ 82,793	13	2,238,853	2,139,677	+ 99,176	—	—	—	—	—
	Zafra & Huelva	112	Nov., 1935	9,907	– 1,655	48	124,030	127,888	– 3,858	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend. Salvador and Paraguay Central receipts are in currency.

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchang has proved misleading, the amount being overestimated. The statements from July 1 onwards are based on the current rates of exchange and not on the par value

Electric Railway Traction

Electrification and Subsidiary Works

ANY attempt to obtain an empirical figure, say per mile, for the cost of electrification on any given system, or even to make a comparison between the costs of conversion of different lines, is at once subject to strict limitations by reason of the ancillary works, which vary with each individual scheme and system of electrification. There are occasions on which the cost of the subsidiary works is much greater than the cost of the electrical equipment and its installation, an example which springs to mind being the Rotterdam-Dordrecht extension of the Netherlands Railways, which was opened in 1934. Considerable bridge and station rebuilding works were carried out over a period of eight years, and not all of these would have been put in hand if electrification had not been envisaged for the immediate future. It is such subsidiary works which might or might not have been undertaken apart from conversion which make it very difficult to arrive at just what proportion of the total cost should be charged to electrification.

As a rule the subsidiary works consist of modifications to stations, bridges and other structures in order to obtain the increased clearance required for the overhead construction or third rails; the erection of transmission lines away from the feeder cables alongside the track; the elimination of interference in adjacent communication circuits; and alterations to signalling. The provision of a transmission line leading to the railway is an expensive matter, but is not required unless the railway company has generating plant of its own. For instance, the P.O.-Midi Railway finds that it must construct a 90 kV. line 100 miles long from Eguzon on the electrified Orleans-Brive line, across country to Poitiers on the Tours-Bordeaux line, before the electrification of the latter section can be accomplished, and current supplied from the railway's own hydro-electric plants in the Dordogne. Interference with telegraph and telephone circuits is a characteristic of the single-phase system rather than of d.c. traction, and on the 16 kV. 16⅔-cycle electrified lines of the Swedish State Railways it caused so much trouble that long and costly research had to be undertaken before it could be eliminated. On the Augsburg-Nuremberg 15 kV. 16⅔-cycle extension of the Bavarian electrified division of the Reichsbahn, opened early in 1935, the cost of eliminating interference in communication circuits was 15½ per cent. of the cost of electrification (neglecting the cost of the new rolling stock); track, station, and bridge alterations amounted to 25 per cent. of the total; and alterations to signalling and lighting, 4 per cent. On the Stockholm-Gothenburg, Stockholm-Malmo, and Stockholm-Ange sections of the Swedish State Railways, the cost of those ancillary works comprising alterations to stations, bridges, signals, and communication circuits amounted to 21 per cent. of the total outlay, *i.e.*, including the cost of the electric locomotives. If d.c. track circuits are in use, they must be changed to a.c. if it is decided to have a d.c. electrification, and, if an a.c. electrification is being carried out, the track circuits will have to be modified to single-rail d.c. or changed to a.c.

Long-Distance Electric Journeys

THE ROME EXPRESS has been diverted from the coast route between Pisa and Rome to the inland route via Florence and Chiusi, and now has fair claims to be hauled by electric traction for a longer distance than any other train in Europe. The total distance over which an electric locomotive is used is 530 miles, but this is divided, by the steam-hauled section of 49½ miles between Pisa and Florence, into two portions of 333 and 197 miles. The 333-mile haul between Chambery, on the P.L.M. system in France, through the Mont Cenis tunnel, Turin and Genoa to Pisa, will soon be increased to 354 miles by the westward extension of electrification on the Culoz-Chambery section. As the Italian main line is now electrified south of Rome to Naples and Salerno, 166 miles, the second electrified section over which trains from the north can run is extended to a total of 363 miles from Florence. And as the Direttissima, which forms part of the inland main line to Milan, is electrified, eventually it will be possible to travel by an electrically-hauled train all the way from Bologna to Reggio, 675 miles, for the Salerno-Reggio section is being converted. The Arlberg-Orient Express is hauled electrically for a total of 515 miles, 391 miles continuously between Basle and Salzburg and 124 miles between Hegyeshalom and Budapest. The continuous haulage over one stretch thus beats the continuous electric mileage of the Rome Express, which is exceeded also by the 373 miles from Stockholm to Malmo on the Swedish State Railways. The Arlberg-Orient total of 515 miles in two divisions is equalled by the continuous journey of 515 miles between Geneva and Salzburg by through carriages from Geneva to Vienna. In this case the electric system throughout is single-phase 15,000 volts, whereas the electric journey of the Rome Express begins on 1,500 volts d.c., changes to 3,700 volts three-phase, and after the short steam section, finishes its journey over nearly 200 miles of 3,000 volts d.c. The Barcelona Express is another well-known train hauled for much of its journey by 1,500 volt d.c. electric traction. For the first 316 miles of its run, from Paris to Brive, the train is in charge of a 2-Do-2 electric locomotive of 4,000 h.p., one from Paris to Vierzon and another from Vierzon to Brive. After a steam-hauled gap of 101 miles from Brive to Montauban, the succeeding 125 miles to Narbonne are run behind electric locomotives. By the end of this year the electrification of the Brive-Montauban section will be finished, and the train then will run for 542 miles without a break behind electric locomotives. The present European distances are beaten in America by the cross-continent journey over the Chicago, Milwaukee, St. Paul & Pacific Railroad, on which the train is hauled by 3,000-volt d.c. locomotives over the 441 miles from Harlowton to Avery, and then, after a steam division, over the 218 miles from Othello to Seattle. By the inter-working arrangements between the New York, New Haven & Hartford and Pennsylvania Railroads it is possible to make a through journey between New Haven and Washington, a distance of approximately 315 miles.

Some Systems of Regenerative Control for D.C. Railways

A correspondent discusses some new methods evolved on the Continent

IN direct-current railway operation, current is regenerated with compound motors, with shunt motors and series machines connected to shunt motors, or with separately excited series motors. The best method of control normally will be that giving in general ordinary operation the greatest possible gain of current at a maximum of dependability and a minimum of accessories. A further point is that in some cases the regenerative system will be applied to new vehicles, whereas in others existing vehicles will be rebuilt. The methods of control to be described require some changes in existing equipment or, at most, the use of some additional apparatus or machines. Regeneration with compound motors will not be dealt with in detail, because in this case the control apparatus and motors must be rebuilt, while, on the other hand, compound motors are not suitable for every mode of operation. For the remaining possibilities, there are three control systems for current regeneration, all of which are suitable for incorporation in new or existing d.c. vehicles.

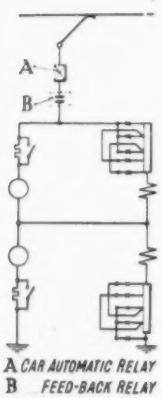


Fig. 1—Wiring diagram of regenerative control with self-excitation of motors as evolved by the A.E.G.

Safe and dependable operation must be ensured in the event of a motor failure, or of failure of the line current during the regenerating process, and must be safeguarded by precautionary measures in the event of excess voltage. Besides, ample provision must exist to ensure action of the brake at the proper moment, shockless transition from regenerative to short-circuit braking, and shockless application of the short-circuit brake in case the regenerative current should fail for any reason.

Control with Self-Excitation of Motors

Control with self-excitation of motors, see Fig. 1, comprises an automatic relay, a regenerative feed-back relay, and two field weakening resistances. In addition to these parts which are common also to the remaining systems of control, there are two special lug or drum type controllers, two starting and braking resistances, and two stabilising resistances.

The motors are connected in series-parallel with corresponding starting steps and a field-weakening notch each in series and in parallel. Two resistance sets, of the ohmic value required for starting, and placed side by side, are used. In short-circuit braking, each traction motor and one of the sets of resistances form automatically a braking short circuit. The two braking circuits are in series, so that the series-connected armatures are excited over the resistances from the main fields, which are connected as shunt fields. The separation of the braking circuits makes for increased safety, since one motor is left for braking in the event of failure of the other. In case of over-speeding of the motors, the ohmic value, which is high enough by reason of the series connection of the two resistance sets, restricts the short-circuit braking current to about normal, and thereby prevents detrimental excess currents and voltages in the armatures, which in regenerative braking are connected in series. The division of the resistances also gives favourable current loading for the controller contacts and cables, because in traction as well as in braking, most of the conducting parts carry the current for one motor only.

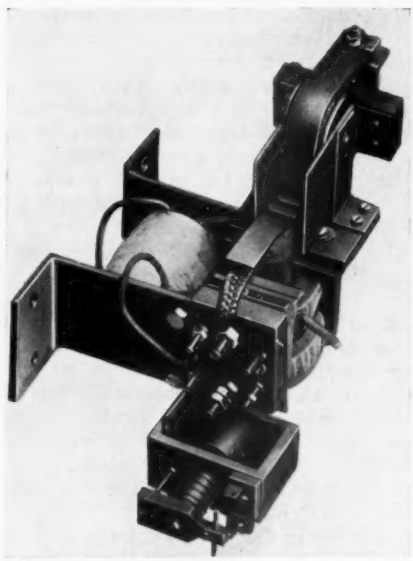


Fig. 2—Polarised feed-back relay used with self-excited system of regenerative control

Regenerative braking on the A.E.G. system starts with self-excitation of the traction motors. A rapid-action polarised feed-back relay, Fig. 2, establishes connection with the supply system during self-excitation as soon as the motor voltage rises slightly above the line voltage. The regenerative current which then starts to flow may be regulated by gradually cutting out the series resistances, and the car can thus be braked down to about 6 m.p.h. When the motor voltage drops below the line pressure, the feed-back relay cuts the supply from the braking motors, and the short-circuit brake superimposed upon the regenerative brake can be strengthened by short-circuiting the series resistances. In this manner, shockless transition from regenerative to short-circuit braking is attained without interruption of the flow of power. Five positions are provided in which the regenerative brake

may act when the motor voltage is high enough. In the following three positions, only the pure short-circuit brake is active. All of the eight braking notches provided work also by short-circuit braking if no regenerative braking can take place.

In previous systems of control, the feed-back relay used to work in conjunction with a polarised relay, but experience has shown that within the time required with this arrangement, the rapidly-rising brake voltage goes up so high as to cause the generation of heavy closing currents at the moment of connection to the supply, with resultant arcing. Because of the rapid action of the apparatus united in the polarised relay, the latter connects the motors to the supply as soon as the voltage

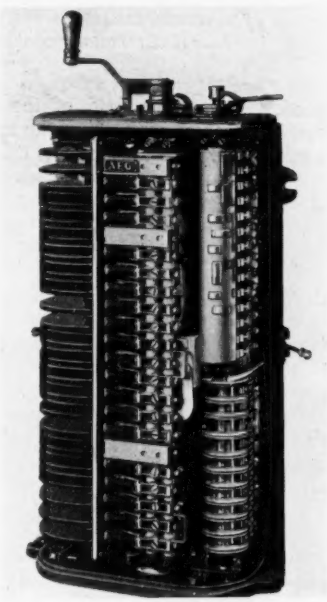


Fig. 3—Lug-type controller for self-excited system of regenerative control

of the series-connected motors is slightly above the contact line pressure, and so prevents further increase of the motor voltage. The relay, moreover, perfectly adapts itself to any fluctuation in line pressure, inasmuch as it is not bound to any rigid voltage figure but operates always on the basis of the difference between the line and braking voltages.

Where gaps occur in the collecting wire, the voltage of the motors rises with high road speed because no regeneration can take place. To avoid a heavy starting shock upon recontact of the collector with a current-carrying wire, an excess-voltage coil is incorporated in the relay which cuts out the main contacts and prevents re-connection of the regenerative brake. Braking of the vehicle is not interrupted, since it is taken over by the short-circuit brake. A similar action takes place in the event of failure of the line voltage.

For purposes of damping circuit-closing current rushes at high road speeds, such as would induce over-braking where the rails are in a greasy condition, resistances are inserted during the regeneration process in the two armature circuits immediately ahead of the armatures. These resistances are short-circuited by the controller after the first regenerative braking notches, for it is only in these positions that heavy currents are to be feared. In the traction positions, the resistances are made inactive by short-circuiting. Fig. 3 shows a controller arranged according to the system indicated in Fig. 1.

Control with Separate Excitation of Motors

By comparison with the arrangement just described, control with separate excitation of the motors, Fig. 4, requires in addition a motor-generator and a braking commutator. The control contains corresponding notches in series-parallel connection with two resistances connected in a manner similar to that described above. The short-circuit brake connection is the same as that of the first system, whereas the regenerative connection is different.

The braking process takes place in the following manner. In the engagement of the contacts in braking position 1, self-excitation of the motors first induces short-circuit braking, and the motor-generator for separate excitation is fed from the line. The braking voltage rises above the line pressure, and the polarised feed-back relay at once closes the circuit between the supply and the braking motors, thereby starting regeneration. Immediately after, the coil of a braking commutator is connected to the line voltage by the auxiliary contacts of the feed-back relay. By this action the braking commutator is reversed, to

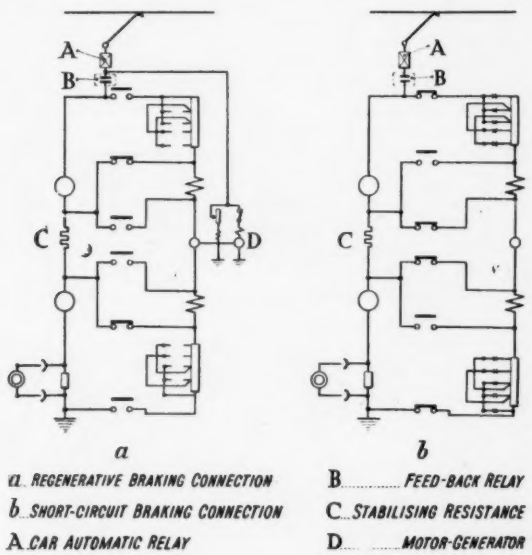


Fig. 4—Diagram of A.E.G. regenerative control with separate motor excitation for application to new vehicles

bypass the short-circuit brake resistances and establish the connection for separate excitation by the motor-generator.

The change-over from short-circuit to regenerative braking and *vice versa* therefore takes place also here without interruption of the flow of power in the two positions 1 and 2 provided for regenerative braking. In position 2, the regenerative braking operates with increased torque because of the regulation of the generator field. Contrary to the process in the previously described control arrangement, regenerative braking in position 1 continually reduces the travelling speed through the corresponding characteristic of the motor-generator. With the regenerative brake, the speed can be brought down to about 6 m.p.h. At this speed regeneration ceases, the polarised feed-back relay cutting the motors off the line. The auxiliary contacts on the polarised relay for actuating the braking commutator open, and the commutator is returned to its basic position by a spring. This causes the motor-generator to be cut off and the braking resis-

tances to be cut in, thereby restoring the short-circuit brake. The controller therefore is given the usual number of braking notches, as for instance seven, of which two are regenerative. One of these steps merely serves for regulating the braking force. The remaining five steps are for short-circuiting, while the two regenerative notches also become available for short-circuiting in the event of failure of the line voltage. After slowing down by the regenerative brake to about 6 m.p.h., the driver must go to whichever short-circuit notch gives the correct braking resistance for the prevailing speed.

The motor-generator, Fig. 5, is of simple design and of welded construction. Because of its compact form, it can be easily accommodated in any motor-coach. Its weight is only 265 lb. In point of safety and avoidance of over-voltages and closing rushes, this system offers the same advantages as the one with self-excitation previously described. The accessory equipment is more costly, as a motor-generator and a brake commutator are required.

Another Control with Separate Excitation

Apart from those components which always remain the same, a third control system, see Fig. 6, requires only a starting and braking resistance, a motor-generator, and a stabilising resistance. The series-parallel connection serves for traction as in the case of the other systems, and only the sequence of the motors is different. There are seven braking positions, of which the first is exclusively used for regenerative braking, while the remaining six are pure short-circuit braking notches. The short-circuit braking connection is of a special crossed type. By the use of this method, existing controllers can be converted into controllers for regenerative operation, as regenerative braking control may be produced at a small extra expense for additional contacts and by the re-arrangement of existing contacts.

Regenerative current while travelling is obtained when the driver cuts in the one and only regenerative notch. By this action, the auxiliary motor of the exciter-generator is pre-connected to the line and brought as rapidly as possible to full speed. In this position, the two series-connected motor fields are separately excited with the aid of the exciter generator until the voltage of the motor armatures exceeds the line voltage by a pre-determined amount. At this moment, the polarised feed-back relay automatically responds and establishes connection between the network and the motors. The armatures therefore supply current to the contact line, and in doing so create a braking force.

By proper selection of the characteristic of the exciter-generator, a braking action gradually increasing in a predetermined measure can be attained down to a certain

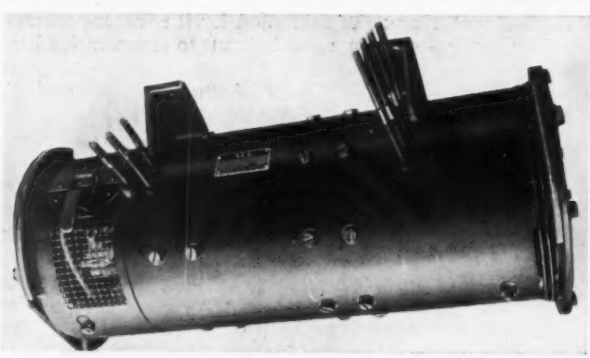


Fig. 5—Motor-generator for regenerative control with separate excitation

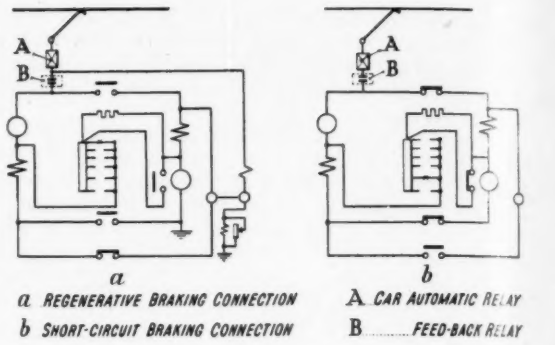


Fig. 6—Diagram of separate excitation regenerative control for use in rebuilt motor coaches

minimum speed. The return feed of the armature into the line thereupon ceases, and when the speed has been reduced to about 6 m.p.h., the polarised feed-back relay disconnects the motors from the line. This type of characteristic of the exciter-generator may also, of course, be employed in connection with separate excitation control system just described.

Transition from regenerative to short-circuit braking is accompanied by a short interruption of the power flow. This is unavoidable because the starting and braking resistances connected in series in the short-circuit braking notch 2 must be completely short-circuited in the regenerative braking position. In braking, the controller must therefore be handled in a somewhat different way from that with usual controllers. Having used the regenerative brake and decreased the speed of the vehicle to the bottom limit, the driver must, after an intervening momentary power interruption, find the short-circuit position which is just right for the prevailing ohmic value. A single regenerative notch is provided in this system because no superimposing of the two brake systems is possible.

In the event of failure of the line voltage when braking on the level or on a down grade, the controller handle must at once be turned to the short-circuit position. In such cases, the no braking effect will be obtained in notch I. In case of danger, he will be compelled to throw the handle through the regenerative notch over to the short-circuit notches.

Changes in the braking force following fluctuations in the line voltage are held down by means of a stabilising resistance taking both regenerative and exciter current. Any undue increase in the regenerative current induces increased throttling of the voltage, with weakening of the field excitation and a resultant drop in the over-voltage in the armatures. It is also an advantage that the polarised feed-back relay automatically adapts itself to the line voltage fluctuations and therefore acts very rapidly as soon as the regenerative notch is engaged, so that the armatures are not left any opportunity of running up their voltage to too high a figure through the separate excitation. Because of the union of the two means, regenerative braking will always start smoothly and the wheel sets will therefore never be caused to slip.

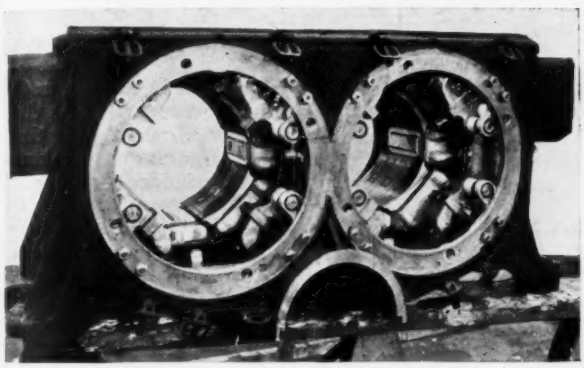
In the event of a cable breakage or disturbance in a motor, the braking system under discussion does not provide any braking reserve such as is afforded by the two previously described systems. This is an unavoidable consequence of the method of crossed braking connection. Fig. 6 shows a connection of the exciter-generator and motor which can be applied also to the separately-excited system described previously.

NEW BELGIAN ELECTRIC LOCOMOTIVE

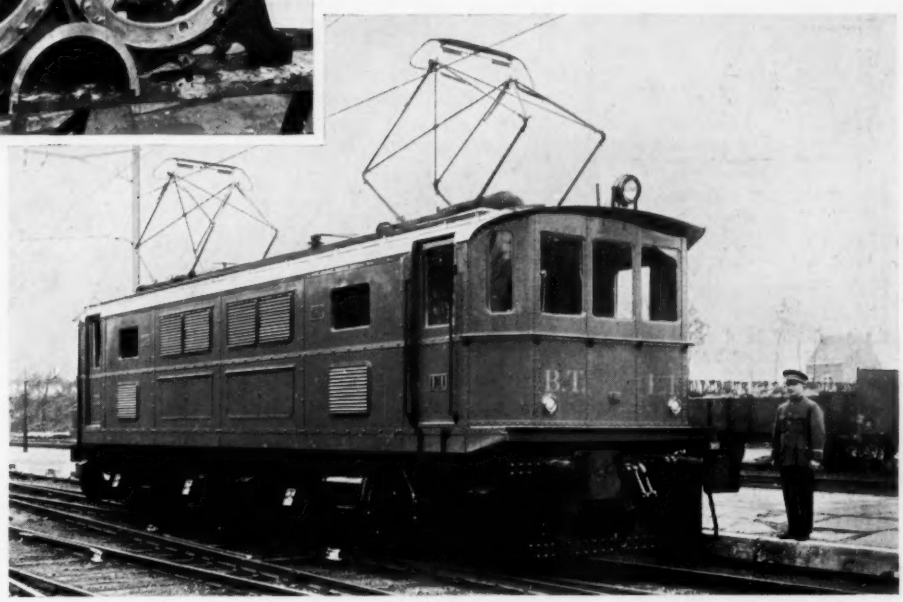
Double-bogie design for 1,500-volt d.c. line

THE first electric railway in Belgium, apart from certain lines of the National Light Railways, was the standard-gauge Brussels-Tervueren Railway, described in THE RAILWAY GAZETTE for July 14, 1933. At that time only the passenger traffic was worked electrically, by motor-coaches, but now the goods traffic has been turned over to electric operation, and a 1,000 h.p. locomotive has been delivered by the Atéliers de Constructions Electriques de Charleroi (A.C.E.C.).

Of the double-bogie layout, the locomotive scales 63·5 tonnes, and is being used for the haulage of trains varying from 300 to 600 tonnes in weight, and occasionally for passenger trains weighing 150 tonnes at speeds up to 43 m.p.h. The bogies carry the draw and buffing gear and have an articulated connection between the inner headstocks, the wheel arrangement being thus Bo + Bo. Braking is on the Westinghouse system with both straight and automatic applications. The arrangement of the cab interior follows normal practice, the electrical apparatus being mounted in a central compartment with a driving cabin at each end, but the side plates of the apparatus room can be taken off very easily so that the equipment may be installed or taken out readily.



Above: Assembly, without armature, of twin traction motor of 250 h.p. The armatures are wound for 750 volts



Right: A 1,000 h.p. 1,500-volt d.c. locomotive built for the Brussels-Tervueren Railway by the A.C.E.C.

Compared with normal double-bogie locomotives, the electrical equipment is unusual in that nose-suspended motors are not fitted, the tractive power being derived from four double-armature motors driving the wheels through the medium of Secheron individual axle drive, so that the weight of the motor is entirely spring-borne. Each armature is wound for 750 volts and connected permanently in series with its fellow, but the insulation is suitable for the line voltage of 1,500. The four motors can be connected in series, series-parallel, and parallel, and have a normal hourly rating of 250 h.p. each with the voltage in the contact wire at 1,350. At the moment, the motors are self-ventilated but provision has been made for installing forced ventilation should an increase in power be desired.

Electro-pneumatic control is embodied, the air for the brakes and the control operation being provided by two motor-driven compressors. The motor-generator set for operating the auxiliaries is located in the central compartment of the locomotive, and has a motor wound for 1,500 volts. The set works in conjunction with a 36-volt nickel-cadmium battery. The 1,500-volt traction circuits are controlled by a servo motor operated by the pressure of air on a piston after the solenoid of an electro-valve has been excited by 36-volt current. The auxiliary circuits operating at 1,500 volts are controlled electromagnetically, and the multiple-unit control equipment is operated by 36-volt current.

All the high-tension equipment is located in a compartment the doors of which are interlocked with the pantographs so that access to the equipment cannot be gained unless the pantographs are lowered. The h.t. equipment includes the main circuit breaker, the starting resistances, the electro-pneumatic contactors, and the fuses. Two pantographs are fitted to the locomotive roof and are operated from an electro-pneumatic valve, the actual raising and lowering being effected by springs. The controller handle has three traction positions, corresponding to four motors in service, motors 1 and 2 in service, and motors 3 and 4 in service.

ELECTRO-MAGNETIC INDUCTION

*Japanese experiments to show the relations between leakage current and the coefficient of mutual induction**

AN experimental study was made with a model on the electromagnetic induction from the electric railway track to the communication line. As a result, the induction voltage as affected by the distance between the contact wire and line was determined. Further, it was found that the amount of induction voltage is dependent upon the amount of leakage current of the electric railway track and the neighbouring soil conditions, as well as upon the distance between the contact wire and communication line. The system used in the experiment was a single contact line 1,500-volt system, with a double-wire communication line.

The voltage which is induced from the contact wire of an electric railway of the single contact system to a communication line running parallel to the wire has been expressed in the following equations :—

$$V = C\, I_o\, l M_d \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

$$M_d = \frac{2d}{b} \times 10^2 \ (\mu \text{ H/km}) \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

where I_o = pulsating current in contact wire

l = length of section in which contact wire and communication line are parallel to each other

M_d = coefficient of mutual induction of contact wire and communication line

d = distance between wires of communication line

b = distance between contact wire and wire of communication line which is nearer to contact wire

C = constant.

A close examination showed that there were three kinds of induced voltage, namely, that due to the current on the contact wire, that due to the current in the rail, and that due to the current flowing through the earth. As the last is affected by the conditions of the current flowing through the earth, the earth current must naturally be taken into account in the study of such an induced voltage. The

* From a Paper by T. Hattori and K. Kimusa before Japanese Institute of Electrical Engineers.

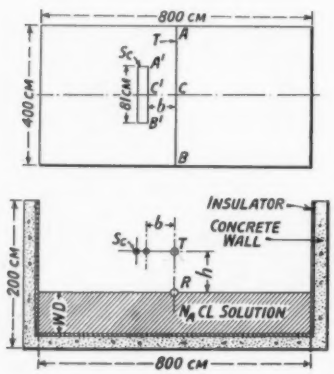


Fig. 1. (above)—Diagrammatic representation of tank used in experiments on induced voltage

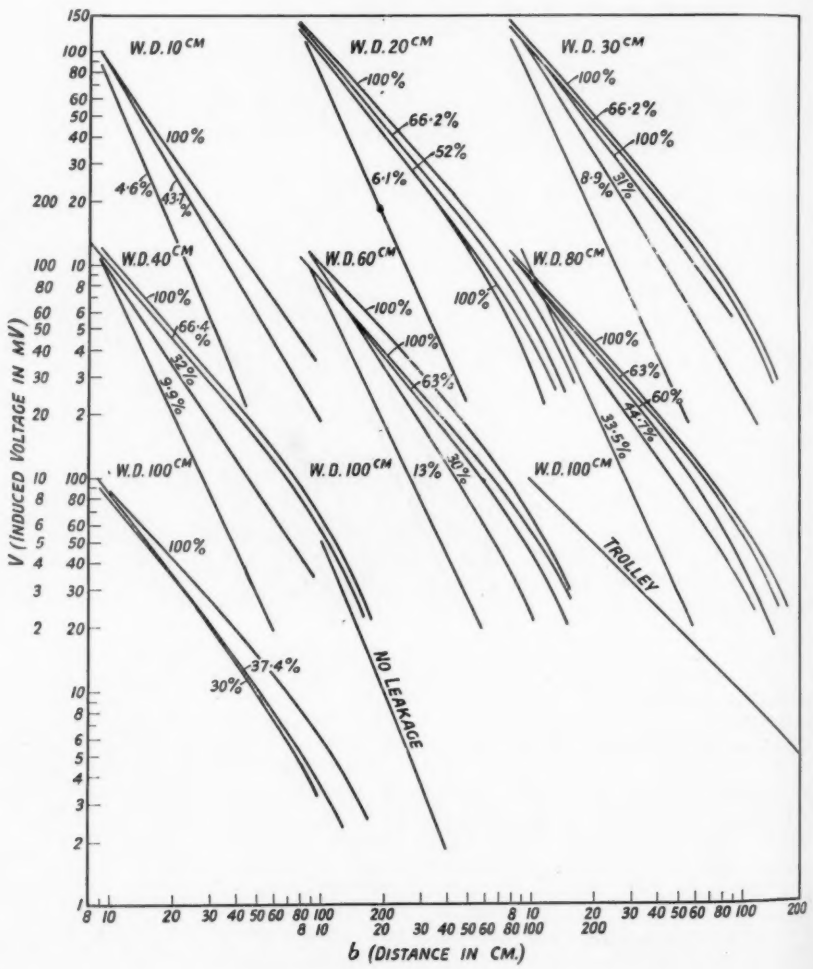


Fig. 2 (right)—Diagram shows the relation, as determined by experiment, between the induced voltage, V, and the distance b, between the contact wire and the communication line

amount and distribution of this current are governed by the following factors :—

(*a*) Leakage factor of electric railway track (αL).
(*b*) Structure of ground.
(*c*) Kinds of load, &c.

Experiments were carried out to ascertain the relation of M_d in equation (2) to the amount of leakage current from the electric railway track and the structure of the ground. Although pulsating currents of different frequencies flow through the contact wire, the experiment was made with a 50-cycle pulsating current for reasons of the laboratory equipment.

The conductors T and R representing the contact wire and rail respectively were placed in a 800 cm. × 400 cm. × 200 cm. concrete tank coated inside with an electrical insulating material, as shown in Fig. 1. R was partially soaked in an electrolyte in such a manner that a portion of current in it leaked out into the electrolyte. T and R made a short circuit at the point A, and a 50-cycle, 10 amp. alternating current was supplied at B. A search coil (S_c), 81 cm. long, 2·6 cm. wide and of 1,230 turns, which represented the communication line, was placed parallel to T at the same height. Thus, the voltage induced in the search coil (S_c) was measured. The electrolyte was NaCl solution, and the amount of leakage current was varied by changing the concentration of the liquid. Besides, the depth (W D) of the liquid was varied, and the relation between the depth and amount of leakage current was observed.

Fig. 2 shows the results of experiment. In this diagram b is taken as abscissa and V (induced voltage which is proportional to the coefficient of mutual induction M_d) as ordinate. The suffixes to the curves represent the ratios in percentage of the maximum leakage current of R.

The relation between M_d and b has so far been expressed in equation (2). But the result of the experiments shows that it is not fully represented by this equation. It must be expressed as

$$M_d = 2\frac{d}{b^P} \times 10^2 \ (\mu H/\text{km}) \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

Equation (3) can be reduced to

$$\log M_d = C - P \log b \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

P in equation (4) stands for the inclination of the curves. It varies, though very slightly, with the depth of soil, too (1·2 to 1·1 for 100 per cent. leakage), and becomes smaller with the increase of depth.

Brevities

BRIGHTON TRAFFIC INCREASE.—At a luncheon given by the Brighton Publicity Committee, Mr. R. Holland-Martin, Chairman of the Southern Railway, said that in 1934 the number of passengers carried between London and Brighton had risen since electrification from 9,677,754 in 1932 to 12,719,296, and that for the first nine months of 1935 there had been an increase of more than 200,000 over the corresponding period of 1934.

SWEDISH PRIVATE ELECTRIFICATION.—The Bergslagernas Railway has invited tenders for the electrification of the main line from Gothenburg to Aamaal, 102 miles, and for the supply of the necessary electric locomotives, at a total cost estimated at 10,100,000 kr. It is expected that proposals for the conversion of the line from Mellerud, on the Bergslagernas Railway, to Kornsjo on the Norwegian frontier, belonging to the Dalsand Railway, will become part of the Bergslagernas scheme before the government approval is given.

LONDON TRANSPORT.—According to the report of the London Passenger Transport Board for the year ending June 30, 1935, the railways of the Board carried 445,888,289 passengers compared with 415,881,626 in the preceding year. The total number of passengers carried by the Board's railways, buses, trolley-buses, and trams amounted to 3,582,348,430. The working expenses, neglecting renewal provision, were 5·809d. per car-mile for the railways, this being an increase of 0·139d. per car-mile over the previous year.

NEW P.O.-MIDI TRANSMISSION LINE.—Preparatory to beginning the electrification of the Tours-Bordeaux main line, the P.O.-Midi Railway is about to begin the erection of a 90 kV. transmission line from the Eguzon station on the Orleans-Toulouse line across country to Poitiers, whence the line will go north to Tours and south to Pessac, near Bordeaux. At Pessac, the e.h.t. line will connect with the supply system of the Midi, and the Tours-Bordeaux line thus will be fed jointly from the P.O. hydro-electric plants in the Dordogne and from the Midi plants in the Pyrenees. The total length of the new supply network will be 295 miles.

Streamliners for New Zealand

The English Electric Co. Ltd. has received a contract from the New Zealand Government Railways Board for eight 1,340-h.p. electric locomotives for operating passenger, freight and mixed trains on the Wellington-Paekakariki section in the North Island. The new locomotives will be of the 2-8-4 type, weighing 84 tons and having an overall length of 46 ft. They will be fitted with electro-pneumatic control and will operate from an overhead line at 1,500 volts d.c. A feature is the streamline design, and these will be the first British electric locomotives to have such a contour. Other points of engineering interest are embodied in the motor drive, ventilation and heating arrangements. The four driving motors are to be spring-borne and transmit their power to the driving axles through flexible spring cup gear. The intake air duct for the locomotive bodies is to be provided with filters so that not only the main motors, which are forced-ventilated, but all auxiliary motors and the control gear will be provided with dust-free ventilation. Each locomotive will carry an oil-fired boiler to supply the steam heat for the passenger coaches.

Of the eight locomotives comprising the order, one will be built complete in England, and the New Zealand Government Railways will build the mechanical portions of the remaining seven in their own shops, obtaining the axles, wheels, air brakes and other details from this country. The English-built mechanical parts will be manufactured by R. & W. Hawthorn, Leslie & Co. Ltd., and the eight electrical equipments by the English Electric Co. Ltd. This order covers the stock for the third section of main line electrification in New Zealand (the Wellington-Packakariki section in the North Island). Both previous sections, viz., Arthur's Pass and Christchurch-Lyttelton in the South Island, were equipped by the English Electric Co. Ltd.

The new tunnel deviation on the first section of the Wellington-Auckland main trunk line, on which the locomotives will work, avoids a heavy gradient over mountainous country soon after the line leaves Wellington city, and will greatly reduce running costs, as well as assist to speed up the main railway traffic. This electrification is part of a reorganisation of Wellington terminal.

NOTES AND NEWS

Madrid Metro Extension.—The Metropolitan Railway of Madrid is seeking powers to construct a 2-km. extension of their system in a north-westerly direction from Callao to Argielles. The cost is estimated at 12,000,000 pesetas and the construction time at two years.

Glasgow Subway Traffic Increase.—Since both circles of the Glasgow Subway were electrified the traffic has increased appreciably, and for the week ending December 14, 1935, the number of passengers carried was 389,593 and the receipts £1,873, compared with respective figures of 295,264 and £1,374 for the corresponding period of 1934.

A 50-Mile Tube ?—A member of the Manchester and District Town Planning Committee has just advocated the construction of an underground electric transport system which would spread from Manchester as an apex to Liverpool, Southport, and Blackpool. Other members appeared as if they would be content if the present railways to those places were electrified, but suggested that a tube line should be built to connect Wythenshawe with the centre of Manchester.

New U.S.S.R. Electric Lines.—The important line from Zaporoshie to Debalzevo, in the Donbass, has been electrified on the 3,000-volt d.c. system, and is being worked by Russian-built Co-Co locomotives of about 120 tons in weight. The line has a heavy mineral traffic, and most of the trains load up to 2,000 tons. The conversion of the Sverdlovsk–Gorobladgodatskaia line in the Urals is expected to be complete within the next three months.

New Italian Locomotives and Cars.—For the operation of heavy goods trains on accelerated schedules over the Florence–Rome–Naples and Naples–Foggia lines, which are electrified on the 3,000 volt d.c. system, the Italian State Railways are putting into service some 180-tonne locomotives of 5,640 h.p. on the one-hour rating. The wheel arrangement consists of two six-axle units each of the Bo + Bo + Bo type, but the centre unit is on a rigid frame and the two end units are bogies. The maximum axle load is only 16 tonnes, and the top speed is 58 m.p.h. On the one-hour rating the locomotive can exert 84,000 lb. tractive effort at 24 m.p.h. or 37,500 lb. at 55 m.p.h. The wheels are of 49½ in. diameter and the complete double-unit locomotive is 95 ft. long. The traction motors are of the nose-suspended type wound for 1,500 volts.

In addition to the six three-car streamlined, articulated trains for 3,000-volt d.c. lines ordered from Ernesto Breda, and briefly described in THE RAILWAY GAZETTE for January 18, 1934, some single-unit light-weight, streamlined motor coaches for speeds up to 75 m.p.h. have been ordered. They are to have two 200-h.p., 1,500-volt motors and will tare about 26 tonnes. First and second class accommodation is to be provided, and the cars will work solo only. Further developments are the building of multiple-unit trains for suburban and secondary lines, and some streamlined three-car trains which will have a top speed of 80 m.p.h. compared with the 100 m.p.h. of the Breda trains.

Egyptian Electrification.—A recent meeting of a departmental committee of the Egyptian State Railways considered afresh the subject of the conversion of certain lines round Cairo, and adhered to decisions previously reached, as follow: (*a*) That the present density of traffic on the Helwan line, or the probability of the density being increased by electrification, is not enough to justify the expenditure which would be incurred. (*b*) That no electrification scheme which does not include a low-level connecting link between the Helwan and Mataria lines has any chance of commercial success. (*c*) That no intermediate step (such as tramways) between the present arrangements and complete electrification would justify itself. (*d*) That any programme of electrification should begin with the Mataria line, proceed with its extension through Cairo to Bab-El-Louk, and end with the Helwan line. (*e*) That as a preliminary step, and as a measure tending to improve the Helwan line service, the section from Bab-El-Louk to Sayeda Zeinab may be doubled, and carried below street level, provided that it is accepted that this step would form part of the complete future electrification project.

Publications Received

Switchgear.—A 20-page brochure describing the latest types of metal-clad switchgear for rupturing capacities up to 1,500,000 kVA. is to hand from the English Electric Co. Ltd. The usual descriptive material is considerably enhanced in value by a sectional view of a 22-kV. unit, as well as by over 20 further illustrations.

Batteries for Traction Work.—Constant improvements in the lead-type battery during the last few years have enabled it to maintain its position in the traction field, and the work done by the D.P. Battery Co. Ltd., of Bakewell, has enabled that firm to put forward cells specially designed for the different classes of traction duties. The full range of Kathanode cells is described, with particulars as to capacity, weight and dimensions, in an illustrated booklet just issued by the D.P. Battery Co. Ltd., the illustrations showing a selection of locomotives up to 50 tons in weight for which these cells provide the motive power. Dualode batteries, a production of the same maker for lighting and starting commercial vehicles, are covered in a separate publication.

In Defence of Electrification.—When is a main line not a main line ? Apparently after electrification. This is one of the interesting points made in a brochure just issued by the British Electrical Development Association, entitled " The Case for Electrification of the Railways." Taking the electrification of the Brighton line as an example, the association states that the very persons who regarded this scheme of conversion to electric working as impossible for a main line now say that the London-Brighton service is suburban in character. This is an implied compliment to electrification, as it is tantamount to saying that the old and possibly rather meagre service of fast express and slow steam trains sometimes associated with a main line are things of the past. Experience in Great Britain and abroad shows that suburban traffic is always well above the critical density which is held to make electrification a safe investment. Yet the Weir Committee found that the average density of typical suburban schemes is but little greater than that carried on a considerable mileage of main lines. This very important finding means that electrification of much of the British main lines is, on this basis, justified by existing traffic, not to mention the additional traffic that might be attracted. It is a significant fact that during 1934 the Southern Railway (the line with the greatest length of electrified track in Great Britain) was the only system to report an improvement in earnings per passenger train-mile. The brochure ends on the optimistic note that the Twentieth Century will go down in history as the era of electric railways.